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SUGGESTIONS

TO

SOUTHERN FARMERS.

PREPARED IN THE DIVISION OF PUBLICATIONS.

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LETTER OF TRANSMITTAL.

U. S. DEPARTMENT OF AGRICULTURE,
DIVISION OF PUBLICATIONS,
Washington, D. C., May 19, 1899.

SIR: I have the honor to submit the following manuscript, prepared under my direction in accordance with your instructions, for publication as Farmers' Bulletin No. 98.

It consists of a summary of papers read at an Interstate Farmers' Convention held at Vicksburg, Miss., February 8–10, 1899. These papers were, in accordance with your proposition to the managers of this convention, supplied to the Department in order that they, or a summary of them covering all the important information they contained, might be published in such a form as would make this information available to the people of the South and the Southwest.

The preparation of this matter for publication having been assigned by your order to this Division, the work was confided to Mr. A. I. Mudd, who has, it is believed, acquitted himself satisfactorily of the somewhat delicate task.

Respectfully,

GEO. WM. HILL, *Chief.*

Hon. JAMES WILSON,
Secretary of Agriculture.

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SUGGESTIONS TO SOUTHERN FARMERS.

INTRODUCTION.

At an Interstate Farmers' Convention held at Vicksburg, Miss., February 8–10, 1899, many prominent and representative men were present, including the Hon. James Wilson, Secretary of Agriculture; Governor Shaw, of Iowa, and ex-Governor Hoard, of Wisconsin.

Addresses of welcome were delivered by Hon. W. L. Trowbridge, mayor of Vicksburg; Hon. S. S. Hudson, on behalf of the board of trade, and Hon. John A. Redhead, on behalf of the agricultural interests of Mississippi, to which suitable responses were made by the first three gentlemen mentioned.

From the other addresses presented at this convention, which were placed in the hands of the Secretary of Agriculture, the following summaries have been prepared by his direction. The necessity of condensation forbade the publication of all these papers in full, and thus necessarily much of the eloquence and grace of diction which characterized these addresses has unfortunately been lost; but an earnest effort has been made to preserve of each one all the practical information the speaker sought to convey. Owing to the fact that no arrangements had been made for reporting the proceedings in full, it has been impossible to reproduce any part of the discussions to which the several papers gave rise.

MISSISSIPPI SOILS AND THEIR CAPABILITIES.

DIVISIONS OF SOILS.

Prof. W. L. Hutchinson, director of the Mississippi Experiment Station, first called attention to a colored map which he said showed the divisions of the soils of Mississippi essentially as made by Dr. Hilgard, former State geologist. The divisions are as follows:

(1) Northeastern prairie region: (a) black yellow prairie, (b) Pontotoc ridge; (2) flat-woods region; (3) brown and yellow loam region; (4) sandy-loam oak uplands region; (5) cane hills region; (6) alluvial or delta region; (7) sandy-loam and central prairie region; (8) pine-woods sandy region.

He then said that the soils of the Northeastern Prairie region are calcareous clays. Part of the soils are black and part are known as

yellow or post-oak prairie. In the western part of this region the land is rolling and the soils of the hills, as a rule, are yellow clays, while the valleys are sandy loams formed by washings from the hills. The soils of the flat woods are somewhat variable, but are mainly heavy clays. The surface is level and therefore the drainage is not good.

The yellow and brown loam region is characterized by soils with a very large amount of fine material or silt of a brown or yellow color lying like a blanket on orange colored sand or gravel, which underlies all of this region. The Yazoo delta is alluvial, or made, land formed by the overflow of the great river or its tributaries. The oak uplands have a sandy or loamy soil with a yellow clay subsoil, and the same is true of the soils of the pine-woods region, though here both surface and subsoil have more sand. The soils of the cane hills are formed of calcareous silt.

THREE CLASSES OF SOILS.

A better practical idea of the soils of the State may be arrived at by dividing the soils into three classes, viz: (1) Those having good water conditions and rich in plant food; (2) those rich in plant food, but with unsatisfactory water conditions, and (3) those with good water conditions but deficient in plant food, and hence require the constant use of fertilizers. These three classes comprise about all the soils in the State, though there may be small areas deficient in plant food and with poor water conditions.

GOOD SOIL.

The speaker said that his audience would appreciate the fact that practical farmers differ very much as to what constitutes a good soil. Many farmers agree with the German's idea, that it is a place to put fertilizers, while others, raised differently, have little patience with land that requires fertilization. The truth is, give a farmer good water conditions, do not let his crops suffer from either drought or excessive rains, and farming is made simple, safe, and easy, even if he does have to fertilize.

The farmer who owns land that takes the seasons as they come and furnishes his crop with a good and suitable supply of water at all times, and whose land is rich in plant food so as not to require the use of fertilizers owns what is known as fertile land. He has a treasure and should be slow to part with it. In every section of the State there are some such soils, and the main bodies of such lands will be found on the well-drained farms in the Delta and in the well-drained valleys and bottoms in whatever section they may occur.

There is a second class lying side by side with the first, and large areas of it are found in Mississippi. They are rich in plant food, but the water conditions are not good, or they are still in forest. They are valuable, too, but only in proportion to the expense and effort necessary to make them like the first. As a rule their owners do not know their

value. They are in the northeastern prairie region, in the brown loam region, in every valley and "bottom" in this State, and in many a so-called "old field." To put them in good shape, frequently nothing is required but a crop of melilotus, cowpeas, or a few crops of lespedeza; and in the valleys and bottoms a few good ditches with an occasional tile drain.

LANDS ON WHICH A LARGE AMOUNT OF FERTILIZERS IS USED.

A section that uses a large amount of fertilizers is usually a prosperous one. The lands have a loam texture, the water conditions are good, and many persons already class such soils as the best. It may be that the time is not far distant when we will all agree with them. Such lands respond promptly and liberally to every well-directed effort. They are easy to till and are safe soils. You can buy them in Mississippi for a song. They are in the pine-woods region and in the oak uplands region. This is the future trucking section of the State, and whenever proper shipping facilities are provided this may become the most valuable section, as truck farming is one of the most profitable branches of agriculture. The plant food in these soils is comparatively small, but the water conditions are good, and for almost any purpose the necessary fertilization is easy. Precisely similar lands along the Atlantic seaboard sell at from $50 to $200 per acre.

For an equal area, probably no other State has more rich soil, and certainly none more good soil, than Mississippi.

Fifty dollars per acre is about the highest market value ever reached by the best lands in the State. This was about forty years ago; and as very little of this value was represented by improvements, the price would indicate a very high degree of productiveness in the soils. Where now, you ask, are these once high-priced lands? When you look on the "old fields" of the State, you see what were once the best lands within her borders. The plant food in them could not possibly have been exhausted in so short a time. Except where they have been damaged by excessive washings or erosion, they are still valuable, and many of them will yet be made to give larger yields than they did in the palmy days of yore. Some of them have been so badly washed and gullied that they are of very little if any value, and are likely to remain so for generations to come.

The clean culture necessary in cotton farming has the effect of rapidly exhausting the humus or organic matter in soils, and for this reason many of the soils are deficient in this very important material. This must be restored as promptly as possible, and by the best means available.

BENEFICIAL EFFECTS OF RESTORATIVE CROPS.

The professor said he would especially call attention to the very marked beneficial effects of restorative crops on worn-out soils. In the prairie section a crop of melilotus has increased the yield of badly

worn soil at least fourfold, the yield being a bale of cotton per acre. There are larger areas of these lands, not so badly worn, where the yield may be doubled by similar treatment. Cowpeas are just as good for this purpose, and they grow well on all kinds of soil in the State. The lands in the different sections are not equally well adapted to all classes of crops or to different kinds of farming. Naturally, they maintain different amounts of water, and this makes one class better adapted to early truck farming and another class to the growing of grasses and forage. Too much stress can not be laid upon the fact that the esteem in which lands in the State have been held has been almost wholly based on their adaptability to growing cotton. Trucking is in its infancy and is practiced in only a few sections, and these may not by any means be the best for this purpose. The values attached to lands by farmers in the State are never based on their adaptability to growing grasses and forage crops.

"In the whole State," the speaker said, "I doubt if there is as much as one township of good land in good condition that is in good pasture grass. We absolutely have no idea of the adaptability of any of our soils to the production of the different grades of tobacco, and yet there is much to indicate that Mississippi has some very fine tobacco soils."

CAPABILITIES OF MISSISSIPPI SOIL.

In regard to the capabilities of the soil of Mississippi and what a Mississippi farmer may do for himself, the speaker said that on every farm in the State the farmer may not only make a good living for himself and family, but can live luxuriously.

There is not a timothy meadow or blue-grass pasture in the State, but with bermuda, lespedeza, carpet grass, alsike clover, red top, turf oats, and hairy vetch good pastures can be made which will furnish grazing equal to any in this country. Red clover can be grown in the northeastern prairie region and in the brown loam region, and cowpeas and lespedeza can be grown in every section of the State. There are probably as good alfalfa soils as may be found anywhere, but the actual demonstration is yet to be made. On the well-drained alluvial lands at the sugar-experiment station in Louisiana Professor Stubbs has grown from 10 to 12 tons per acre. Where properly drained there is no reason why the soils in the Delta region of Mississippi would not do as well. It is grown satisfactorily in the valleys of the northeastern prairie region.

Fifty bushels of corn per acre can be grown in the State.

COTTON STILL PREVAILS.

In conclusion, the speaker said:

We have fine cotton lands, and cotton grows well in all sections except near the coast. I have great respect for cotton. Conventions meet for the purpose of lessening its area; speakers condemn it as unprofitable and ruinous; farmers' institutes

assemble to give it a black eye, but still we see it prevail and we hear the darkey singing in the cotton patch and we see the millions still clothed in it. I have an idea this will continue; but cheap cotton undoubtedly means cheap labor. The man who labors, and wants good wages for it, must needs do something other than produce 4½-cent cotton.

Can a farmer make money on Mississippi soils? If he is industrious, if he studies his business and keeps abreast with the times, if he uses the best business methods, and if he produces the best of whatever he markets, he may hope to gain a competency, not a fortune.

THE DAIRY COW AS A RESTORER OF FERTILITY.

FERTILIZING CONSTITUENTS ABSORBED BY COTTON PLANT.

Prof. T. L. Haecker, of the University of Minnesota, prefaced his remarks with the statement that he had had little opportunity to investigate the conditions obtaining in the cotton belt. He said that the people of that section were probably undergoing an experience which sooner or later comes to every section of our land. Wheat was grown almost exclusively in the North until the soil refused to respond. No one seemed to know why, but when wheat failed they began to depend more upon live stock. As the live stock increased the land brought better crops, and it gradually dawned upon them that the failure of crops was due to lack of fertility, and that by diversified farming they could restore it and secure as good, if not better, returns than they received from the virgin soil.

It is likely that the soil of the cotton belt has been impoverished by constant cropping and inadequate fertilizing. The cotton crop makes heavy drafts upon the soil and if it is not heavily fertilized in return it will become exhausted. The commercial value of the fertilizing constituents absorbed by the cotton plant amounts to $3.83 per acre, aggregating a little over $47,000,000 worth per year. Every dollar's worth of this fertility that has not been returned to the soil is a bonded indebtedness which will exact exorbitant interest by way of reduced crops until that which rightfully belongs to the soil has been returned. The report of the Secretary of Agriculture for the year 1897 shows that during that year 623,386,638 pounds of cotton-seed meal, valued at $5,515,800, were exported from this country to Europe. The fertilizing value alone of this product, at the lowest commercial values, amounts to $6,325,600.

FEEDING VALUE OF COTTON-SEED MEAL.

At the present prices of grains and mill stuffs its feeding value amounts to $9,226,122, making the actual value of the exported cotton-seed meal $15,551,726. All of this is sold to the European dairymen and meat growers for five and one-half million dollars. This meal is converted into products which come in competition with our products in foreign markets.

As to the accuracy of the feeding value placed upon cotton-seed meal there may be some doubt, but to demonstrate its money value as feeding stuff let us examine the subject from the standpoint of the Northwestern dairyman. Only a half dozen years ago bran was a drug on the market, and it was in many cases used as fuel to operate the flouring mills. Now, even in sections where wheat raising is the leading crop but where creameries have been established, not only is all the bran made at the local mills engaged by the farmers weeks in advance, but from thirty to forty car loads are shipped back from the great milling centers into each of the country stations and sold to the farmers for milk and meat production. Does it not seem strange that the farmer should buy and pay cash for mill products when his granaries and bins are loaded with oats, barley, corn, and rye, and when he has more roughness in the shape of hay, straw, corn fodder, and stover than he can use? He pays $10 for a ton of bran. It contains 238 pounds of water. He is certainly not buying the water. It contains 116 pounds of ash, 58 pounds of indigestible protein, 1,258 pounds of carbohydrates, and 80 pounds of fat. It would be absurd for the farmer to pay $10 per ton for these substances when he has more of them at home than he has use for. The only substance in the ton of bran not enumerated above is 250 pounds of digestible protein, and the logical conclusion is that the farmer pays for the 250 pounds of protein.

CONSTITUENT ELEMENTS OF A TON OF OIL MEAL.

A ton of oil meal contains 184 pounds of water, 114 pounds of ash, 72 pounds of indigestible protein, 886 pounds of carbohydrates, and 158 pounds of ether extract, or fat. Surely no sane person would be guilty of buying these substances at the rate of $22 per ton when his farm is already overstocked. As the digestible protein is the only nutrient he lacks, it must be that which he buys. Now, that ton of linseed meal contains 586 pounds of digestible protein. Since the cost of nutrient in bran is 4 cents a pound, the intelligent farmer sees no objection to buying the oil meal at $22 per ton.

CONSTITUENT ELEMENTS OF A TON OF COTTON-SEED MEAL.

A ton of cotton-seed meal contains 164 pounds of water, 144 pounds of ash, 106 pounds of indigestible protein, 584 pounds of carbohydrates, and 262 pounds of fat. As stated before, when the farmer has more of these substances at home than he can use, he therefore buys the digestible protein. Since he can get it in more condensed form and with it less alloy when he buys cotton-seed meal, he finds no objection to paying at the rate of 4 cents per pound for the 740 pounds of digestible protein in a ton of cotton-seed meal, which fixes its commercial value as a feed stuff at $29.60. In the 623,386,638 pounds of cotton-seed meal exported in 1897 there were 230,653,056 pounds of digestible protein, which at 4 cents per pound amounts to $9,226,122. So, if farmers can buy digestible protein at the rate of 4 cents per pound in bran and

oil meal and make it return them 7.53 cents per pound by converting it into dairy products, the estimated commercial value of the exported cotton-seed meal is a very conservative one. The South can not afford to export its cotton-seed meal at any such figure.

The annual cotton-seed crop is estimated at 4,500,000 tons. A ton of cotton seed contains 250 pounds of digestible protein, making a ton of cotton seed and a ton of bran of equal feeding value. With bran at $10 a ton, the feeding value of the 4,500,000 tons of cotton seed would be $45,000,000. Valuing nitrogen at 14 cents, phosphoric acid at 5 cents, and potash at 4 cents, the manurial value of the cotton-seed crop is $49,365,000, making its total annual value $94,365,000.

HOW TO GROW COTTON, UTILIZE THE BY-PRODUCTS WITHOUT REDUCING INCOME, AND RETURN ALL FERTILIZING CONSTITUENTS TO THE SOIL.

The cotton crop of Mississippi covers an area of about two and one-half million acres from which is removed $9,575,000 worth of fertilizing constituents annually. The problem to be solved is: How to continue cotton growing, utilize the by-products on the plantation without reducing the income therefrom, and at the same time return all the fertilizing constituents to the soil? In order to accomplish this, the product must be a staple article that has ready sale, it must uniformly bring a good margin, must be in condensed form so that freight rates will be light, and must not contain any fertilizing constituents.

The speaker said:

I know of only one animal that can fill these requirements, and that is the dairy-bred cow, and the product butter. Butter fat contains no nitrogen. Therefore if the by-products of the cotton plant are fed to cows that do not convert feed into meat, but into milk, all the fertilizing constituents will be found in the skim milk and in the excreta, and if these are retained on the farm and only the butter marketed, nothing will leave the farm that has any value as a fertilizer, and the net return to the cow owner will be 7½ cents in cash for every 4 cents worth of protein consumed.

EXPERIMENT IN DAIRYING.

He then said that on such an occasion opinions are out of place. Therefore he would show the results of an actual and careful experiment covering a period of four months of stall feeding, from January 1 to May 1, when all feed was carefully weighed out to each cow in the college herd, all milkings weighed and tested for butter fat, and analyses made of all food stuffs used.

There were 22 cows in the herd. The digestible protein eaten amounted to 7,150.12 pounds; yield of butter fat, 2,636.71 pounds; and yield of butter 3,076.19 pounds.

The herd consumed on an average 2.42 pounds of digestible protein for each pound of butter yielded, and returned 7.53 cents for every 4 cents worth of protein consumed after deducting cost of manufacture, transportation, and commission. The cost of the protein was much less than 4 cents, and the butter was sold for more than the amount

shown in these calculations, but the figures used are applicable to present conditions and are what may be generally expected as ruling prices under good management. The returns made for food consumed are below what might be realized if a whole winter's work is taken into account. The results given are for the last three months of a seven months' stall-feeding. The cows came in in the latter part of summer and in early fall and had been in milk from three to four months, when the record quoted began. When such results can be obtained in a climate where seven months of stall-feeding is required, as good, if not better, results should be secured in a State where only three months of stall-feeding is necessary.

PRODUCTIVE CAPACITY OF THE DAIRY COW.

The wonderfully productive capacity of a dairy cow is further illustrated by the record of the college herd for two consecutive years. It is a mixed herd composed of representatives of the various dairy breeds and their grades, and grade shorthorns, representing the average cow as found on Minnesota farms. The results obtained are such as may be expected of a fairly well selected herd under good care, but the yield as a herd is better than could be secured from an ordinary herd of common cows.

The cost for feed during the year 1895 at local market prices averaged $28.47 per cow. The average yield of milk per cow was 7,418 pounds, or 872 gallons, and the average yield of butter was 353 pounds. The cost of feed to produce a pound of butter was 8 cents. Valuing the butter at 15 cents a pound and skim milk at 15 cents per hundred pounds makes the gross return $62.68. Deducting $28.47, the cost of the feed, we have a net return of $34.21 per cow.

In 1896 the cost for feed was $22.12; the average yield of milk was 7,454 pounds, or 877 gallons, per cow; the average yield of butter was 349 pounds, and the cost of feed to produce a pound of butter was 6⅓ cents. The gross return was $62.18 and the net return $40.06 per cow.

It is not in the cotton nor in the oil extracted from the seed that the fertility is lost, but it is in the parting with the cotton-seed cake or meal that the loss occurs. If you feed the cake and meal to dairy cows all the fertility will remain on the plantation and your cash receipts will be twice as large as would be the case if this by-product was sold.

VALUE OF THE COTTON-SEED CROP TO THE SOUTH.

The speaker summarized the value of the cotton-seed crop as follows:

I have shown that the annual manurial value of the cotton seed is $49,365,000 and the market value $45,000,000. If converted into butter, it would bring in a net return of $78,750,000. Add to this its manurial value, which you would keep, and we have as the actual value of the cotton-seed crop to the South the fabulous sum of $128,115,000.

To save annually this enormous revenue is a very simple proposition. Go into dairying with the dairy cow.

COTTON SEED AND ITS PRODUCTS.

COTTON, COTTON SEED, HULLS, AND COTTON-SEED MEAL.

Prof. B. W. Kilgore, State chemist and professor of chemistry, Agricultural College, Mississippi, pointed out the great value of cotton seed and its products for feed and other purposes.

He said that Mississippi produced about 1,600,000 bales of cotton during each of the past two years. Cotton as it is picked yields a little less than one-third lint and a little more than two-thirds seed. A cotton crop of 1,600,000 bales, therefore, gives about 800,000 tons of seed, which is 320,000 tons, or 40 per cent short of a 40,000,000 bushel corn crop for the State.

One ton (2,000 pounds) of cotton seed, when treated at an oil mill, yields about 725 pounds meal, 1,000 pounds hulls, linters, etc., and 275 pounds of oil—37 gallons.

Cotton-seed hulls are used as fuel in the engines of oil mills, and very largely as food for cattle. They are worth from one-half to two-thirds as much as grass hay and are an excellent and handy diluent with which to feed cotton-seed meal. Hundreds of thousands of cattle and large numbers of sheep are each winter fattened on hulls and meal at and in the vicinity of the oil mills of the South. Milk cows are also fed on rations made up largely of hulls and meal. The rations fed to fattening cattle are 3 to 4 pounds at first, which are gradually increased to 6, 8, and even 10 pounds per head each day and all the hulls the animals will eat. The proportions have varied from 2 to 6 pounds of hulls to 1 pound of meal, the best results having been obtained on 3 to 4 pounds of hulls to 1 of meal. For long feeding periods and rapid gains this is a most excellent ration.

Numerous experiments have shown that cotton-seed meal produces in the same rations more and cheaper beef than the same amount of corn meal, and generally more than wheat bran, linseed meal, and the other concentrated feeds. Cotton-seed meal stands at the head of concentrated feeds. This is a sweeping statement, but the experiments are numerous, and the evidence upon which it is based is abundant.

In four years' experiments at the Pennsylvania Experiment Station, mixtures of corn meal and cotton seed with coarse foods produced better and cheaper gains than corn meal alone with the same coarse foods, cotton-seed meal replacing more than its own weight of corn meal in the rations and producing the amount of food required to produce a pound of gain.

At the Texas station, in three years' experiments in fattening 160 Texas steers and 8 cows on cotton-seed products on different rations, in comparison with each other and with corn, the obtained results in all cases indicated the superior feeding qualities of cotton-seed products over corn. From these experiments (and a large number of others might be given) it is seen that cotton-seed meal is a better beef pro-

ducer than corn[1]—that a given weight of cotton-seed meal will make more beef than will an equal weight of corn or corn meal. Of the large number of feeding experiments with cotton-seed meal but few are adapted to determining accurately just how much corn meal a pound of cotton-seed meal is equal to.

The experiments at the Pennsylvania station, eight in number, and an experiment now well advanced at the Mississippi station, the result of which the director has permitted the use of with the understanding that it only indicates what the final result will be, are the only ones found suited to the purpose in view.

These nine experiments show that 1 pound of cotton-seed meal has produced in the same rations as much beef as 1.34 pounds to 2 pounds of corn meal, the average being 1 pound of cotton seed to 1.73 pounds of corn meal.

Though it can not be said that this ratio is absolutely correct, or that results corresponding to this ratio will in all cases be gotten with these two foods, yet when fed in the best way in combination with other feeds results reasonably close to it may be expected.

This ratio—1 pound of cotton-seed meal equal in beef-producing value to 1.73 pounds of corn meal—has a significant meaning in Mississippi. Corn and cotton-seed meal have close to the same selling price in her markets.

COMPARATIVE VALUE OF COTTON SEED AND CORN.

The cotton seed is not understood in its home, the South, as it should be, nor is its feeding value fully appreciated. Cotton seed is not so readily eaten as its products, especially meal. Nevertheless, we know it to be a valuable food, and many experiments show that, pound for pound, cotton seed is fully equal in feeding value to corn. Experiments with cotton seed and corn, as with cotton-seed meal and corn meal, have not been generally of such a nature as to enable us to arrive at the exact comparative value of these two materials.

At the Texas station, cotton seed in rations produced cheaper and more rapid gains for short periods than either corn or cotton-seed meal. In long periods the seed loaded the animals with fat so quickly that the rate of laying on flesh was greatly decreased. Raw and boiled seed at $7 per ton made cheaper but smaller gains than cotton-seed meal at $20 per ton. Rations with corn were the dearest ones fed. Two experiments at the Texas station show that 1 pound of cotton seed equals in beef-producing value 1.21 pounds of corn. An incomplete experiment at the Mississippi station shows that 1 pound of cotton seed is equal to 1.06 pounds of corn-and-cob meal. Averaging this and the Texas results give 1 pound of cotton seed equal to 1.13 pounds of corn meal.

[1] The Cotton Plant, Bulletin No. 33, Office of Experiment Stations, p. 385.

COMPARATIVE FEEDING VALUE OF COTTON-SEED MEAL AND COTTON SEED.

Many experiments have shown that cotton-seed meal produces pound for pound more beef than cotton seed, but only a limited number of these experiments are of such a kind as to give anything like a definite idea of the relative beef-producing powers of the two. Two experiments at the Texas station, already referred to, and one now in progress at the Mississippi station show one pound of cotton-seed meal to have produced as much beef as 1.54, 1.36, and 1.50 pounds of cotton seed, respectively.

This shows as an average of the three experiments that 1 pound of cotton-seed meal has made as much beef as 1.47 pounds of cotton seed. While it is not contended that this represents the exact relative feeding value of these materials, it is believed that their values as feeds do not differ widely from the relation represented by these figures, 1:1.47.

MARKET PRICE OF CORN, COTTON SEED, AND COTTON-SEED MEAL.

The market prices of cotton seed, cotton-seed meal, and corn are about as follows:

	Per ton.
Cotton seed, 10 cents per bushel, equal to 30 cents per 100 pounds, equal to	$6.00
Cotton-seed meal, 80 cents per 100 pounds, equal to	16.00
Corn, 40 cents per bushel, equal to 71 cents per 100 pounds, equal to	14.20

Combining the comparative feeding values and selling prices of corn, cotton seed, and cotton-seed meal, the following relations are shown to exist:

First. One pound of cotton-seed meal equals 1.73 pounds of corn meal.

(*a*) When corn is worth 40 cents per bushel, equal to 17 cents per 100 pounds, cotton-seed meal should be worth $1.23 per 100 pounds, equal to $24.60 per ton.

(*b*) When cotton-seed meal is worth 80 cents per 100 pounds, equal to $16 per ton, corn should be worth 46 cents per 100 pounds, equal to 25.8 cents per bushel.

Second. One pound of cotton seed equals 1.13 pounds of corn meal.

(*a*) When corn is worth 40 cents per bushel, equal to 71 cents per 100 pounds, cotton seed should be worth 80 cents per 100 pounds, equal to 26.6 cents per bushel and $16 per ton.

(b) When cotton seed is worth 10 cents per bushel, equal to 30 cents per 100 pounds, corn should be worth 26.6 per 100 pounds, equal to 14.9 cents per bushel.

Third. One pound of cotton-seed meal equals 1.47 pounds of cotton seed.

(a) When cotton seed is worth 10 cents per bushel, equal to 30 cents per 100 pounds, or $6 per ton, cotton-seed meal should be worth 44 cents per 100 pounds, or $8.60 per ton.

(b) When cotton-seed meal is worth 80 cents per 100 pounds, equal to $16 per ton, cotton seed should be worth 55 cents per 100 pounds, equal to 18.3 cents per bushel, or $11 per ton.

These statements, though they are statements, as I believe, of facts, may be somewhat of a surprise to many of you. They are rather concentrated, but not more so than the feeds with which we are dealing. It may be difficult for you to accept them and digest them, yet the animals have digested the feeds and given us the facts and we can not question the findings except through the medium of other animals in other experiments. This method of recourse is open to everyone, and the oftener the statements are questioned and answered in this way, the better will it be for the real truth and the knowledge of these most valuable feeding materials.

QUALITY OF BEEF FROM COTTON-SEED PRODUCTS.

Cotton-seed products beef is good. Despite the occasional statements in the agricultural press that beef produced from cotton-seed products is of poor quality, an examination of all experiments on the subject failed to disclose evidence to justify the statement. It is true that the fat of animals fed on cotton-seed products has a melting point of two to six degrees higher—the fat harder and firmer—than that of animals fattened on corn; but this has not, so far as known, caused any objection to be made against the eating qualities of the beef.

COTTON-SEED PRODUCTS FOR MILK.

Cotton seed and its products are valuable milk and butter producers. They do not injure the milk for drinking purposes, but when fed in too large quantity they give butter a higher melting point and make it quite firm. This is an advantage in a warm summer climate, but at the same time the texture is injured, the butter being sticky and the flavor poor. When, however, seed and meal are properly combined with grain and hay foods this injurious effect on the quality of the butter is not apparent. Three to four pounds of cotton seed or meal may be fed to a cow each day without materially affecting the butter. Cotton-seed meal is valuable as a dairy food, and for mixing with cotton-seed hulls, corn fodder, and the grass hays it has no superior. Numerous experiments have shown cotton-seed meal in the same rations to produce pound for pound more milk and butter than corn meal, wheat bran, or the other grains and concentrated feeds in use. The experiments which have been made for milk production, although made with the view of determining the effect on the health of the animal and the quality and quantity of milk and butter produced, justify the same general statements in regard to milk and butter production that have been made about cotton seed and cotton-seed meal in their relations to each other, and to corn for beef production.

The Mississippi station has for two winters been working on the relative milk and butter producing powers of cotton seed, cotton-seed meal, and corn. The director has allowed the statement to be made in advance of publication that the results indicate that these feeds have

about the same relative milk and butter producing values as has already been stated for them for beef production.

COTTON-SEED MEAL FOR HORSES AND MULES.

Cotton-seed meal has been fed to horses and mules to a limited extent, but there is not much definite information at hand as to the results. In three cases 2 pounds of cotton-seed meal have been fed daily in connection with other grain feeds and hays with good results.

COTTON SEED AND PRODUCTS FOR HOGS AND CALVES.

Nearly all carefully conducted experiments show that neither cotton seed nor meal can be fed profitably to hogs and young calves. They are injurious to these animals, and death frequently results when such feeding is continued. Whether death is due to loose lint, large amount of oil, hard and sharp seed coats, or whether cotton-seed products contain a toxic principle, or whether such is developed as the result of decomposition outside or change within the animal body, is yet an open question, and is an important one, too, to be solved in connection with the problem of feeding cotton-seed products.

COTTON-SEED MEAL AND ABORTION.

It seems to be the well-founded opinion of veterinarians, dairymen, and feeders that cotton-seed meal does not produce abortion. That like similar feeds it can be fed so as to produce abortion, but it is safe and free from producing such results when rationally fed.

COMPARATIVE VALUES OF CORN AND COTTON-SEED CROPS IN MISSISSIPPI.

In 1897 the estimated corn crop of Mississippi was 30,000,000 bushels, equal to 840,000 tons of grain. The cotton crop for the same year was 1,600,000 bales, which would produce about 800,000 tons of cotton seed. This is 40,000 tons, or 5 per cent less cotton seed than corn.

The corn crop of 1898 was estimated at 40,000,000 bushels, or 1,120,000 tons, of grain. The cotton crop was 1,600,000 bales, and 800,000 tons of seed. The cotton-seed crop was 40 per cent short in weight of the corn crop, but, compared on the basis of the feeding value previously stated, it was but 24 per cent less in feeding value than Mississippi's large corn crop. We do not get correspondingly as much out of the cotton-seed crop as we do out of the corn crop. We are lacking in knowledge as to how to feed the seed and its products to the best advantage, and also in stock to feed. We are growing the seed, and can grow the stock.

COTTON SEED AND MEAL AS FERTILIZERS.

The largest part of the nitrogen in the fertilizers sold in Mississippi, about three-fourths, is derived from cotton-seed meal. It is our great and cheap source of nitrogen.

One ton (2,000 pounds) of cotton seed contains:

Nitrogen, 62 pounds, at 12½ cents	$7.75
Phosphoric acid, 26 pounds, at 4½ cents	1.17
Potash, 24 pounds, at 5 cents	1.20
Fertilizing value of a ton of cotton seed	10.12

One ton (2,000 pounds) cotton-seed meal contains:

Nitrogen, 136 pounds, at 12½ cents	$17.00
Phosphoric acid, 56 pounds, at 4½ cents	2.52
Potash, 36 pounds, at 5 cents	1.80
Fertilizing value of a ton of cotton-seed meal	21.32

It requires about 2¾ tons of seed to yield a ton of meal, and a ton of meal contains more than double the quantity of fertilizing materials contained in a ton of seed.

On the same basis, 1 ton (2,000 pounds) of corn has:

Nitrogen, 32 pounds, at 12½ cents	$4.00
Phosphoric acid, 13 pounds, at 4½ cents	.58
Potash, 8 pounds, at 5 cents	.40
Fertilizing value of 1 ton of corn	4.98

This shows that a ton of corn or corn meal contains less than one-half as much valuable fertilizing materials as cotton seed and less than one-fourth as much as is contained in cotton-seed meal.

COTTON-SEED OIL.

Cotton seed oil is obtained by separating the seed coats or hulls from the kernels of the seed and expressing the oil from these. About 26 per cent of the seed of the State of Mississippi goes to the oil mills. A ton of seed yields about 275 pounds, or 37 gallons, of crude oil.

Crude cotton-seed oil is worth about 18 cents per gallon, or 2.3 cents per pound; refined yellow oils 25 cents per gallon, or 3.3 cents per pound, and the white oils 30 cents per gallon, or 4 cents per pound. Refined cotton-seed oil is used for making compound lard, cottolene, and lard substitutes for cooking purposes, and oleomargarine, butterine, and butter substitutes. It has been estimated by experts that 90 per cent of the olive oil sold in this country is cotton-seed oil. Cotton-seed oil sells for from 3 to 4 cents per pound; when called olive oil it is worth 7 cents; under the name of compound lard it sells for from 5 to 6 cents, and when called butter its value goes up to 15 cents per pound.

It is a pure, wholesome, and nutritious oil—a legitimate and necessary constituent in human food, and might with much saving and advantage be substituted for the lard and bacon brought from a distance and consumed in the vicinity of the oil mills.

The estimation in which it is held in foreign countries is shown by the fact that the exportation of cotton-seed oil and its compounds between 1884 and 1893 increased 162 per cent, while the exportation of lard increased only 37 per cent.

THE RELATION OF LIVE-STOCK FARMING TO HOME MAKING.

PURE BREEDS ONLY ARE DESERVING OF ATTENTION.

The following extracts are from the address of Mrs. Virginia C. Meredith, of the University of Minnesota:

By the advanced farmer of to-day it is clearly recognized that the pure breeds of stock only are deserving of his attention—that no other class merits the devotion of his mental and material efforts. It is true that in extensive farming the foundation of herd or flock may be, and generally is, far from being eligible to registry; yet even there the successive sires are usually pure bred; thus the flock and herd grow practically toward purity of breed. The sound common sense which characterizes the American farmer forbids him to keep horses, cattle, or any other live stock merely for fancy. The open market is the ultimate arbiter of values, and it is by this test alone that pure breeds have come to their present established position in farm economy. Early maturity and quality are potential factors in determining a profit price, and so certainly do early maturity and quality inhere in breed that they can not be secured apart from the blood of the pure breeds, whether they be sought in the horse, cattle, or swine. * * *

If one chooses to acquire knowledge of breeds and their adaptations, and then has the decision and energy to apply his knowledge, he is likely to go in the direction where profit lies. Keeping improved live stock enables one to apply exact business principles to his farming. To illustrate: When live stock is the foundation of the farm economy probably half of the acres will be in permanent pastures. Upon these acres the stock will harvest the crop—converting grass into beef, mutton, speed, milk, or butter without any outlay of cash for labor. The remaining acres, devoted to a suitable rotation of crops, will secure stability in the farm operations, the capacity of the teams, the implements, and the men required this year being just what it was last year and just what it will be next year. The coarse products, such as straw and corn stover, which have little value as fertilizers when returned directly to the soil, have immense value when utilized by stock, the stover as food and the straw as an absorbent in the stables, while the labor required in the summer during the active operations of cultivating and harvesting will in the winter be profitably employed in the care and development of the live stock that during the summer has had the freedom of the pasture. On this farm there will be business the entire year; there will be no waste of products that have cost labor and fertility; the crops will go to the market in the form of beef, butter, speed, draft, mutton, wool, or pork, carrying with them the minimum of fertility. * * *

VALUE OF INFLUENCE OF PURE-BRED STOCK UPON THE INTELLECTUAL LIFE OF THE FAMILY.

Quite apart from the enhanced market value, pure-bred stock has another value which is not always estimated at its true worth—the value of its influence upon the intellectual life of the family. One only needs to go into the family home on the farm where pure-bred cattle, horses, sheep, or swine are reared to be convinced of the reality and the beneficence of this influence. If other proof is needed it may be had by comparing or contrasting a home on such a farm with one on the farm devoted to grain farming. It has been said that wheat farming debauches the mentality of the farmer. While this is probably too strong a characterization, yet it graphically suggests the mental vigor promoted by the life on the stock farm. There are some phases of the profession of farming not always well defined in our own thoughts; it is well worth while to consider some of these in their relation to the intellectual life of the farm family. For example, the circle of acquaintance and the associations which inevitably follow one's identification with any particular pure breed of live stock will widen the mental horizon; also the range of reading—

imperative if one would keep abreast of the advance being made by all the pure breeds—will itself strengthen the understanding and broaden the general intelligence. Then, too, the study of nature's methods, the mysteries of heredity, the influence of environment, bring one into intimate sympathetic touch with the great forces or laws that wait upon and reward our intelligence, or perchance punish our ignorance. The more than human response in affection and absolute trust which the horse, and even the Southdown, will make to the master's care teaches the highest lesson concerning our obligation to others. And all these lessons are so easily, so imperceptibly, transferred to other planes of life, where they influence conduct and destiny. When one appreciates intelligently and sympathetically the high privilege of controlling the conditions that create vegetable and animal life he may get a glimpse of that perfect love and perfect justice Divinity exercises toward its creatures.

INTELLECTUAL VIGOR IN THE FARM HOME.

If intellectual vigor is given an outlet on the stock farm, equally true is it that intellectual vigor finds a noble field in the farm home. There have been many definitions of the word "home," all showing some phase that appeals to the speaker. An inclusive definition is something like this: Home is a place and an opportunity for the complete development of the physical, mental, and spiritual natures, and inferentially for the sane enjoyment of life. The farm home offers peculiar opportunity for the development of the physical. This goes without saying. A happy childhood in the open air is the inheritance of the farm child, and the force of sunlight, pure air, and exercise are well-nigh conclusive in determining physical completeness. The nearness to great forces in vegetable and animal life, if at all utilized, must awaken powers of observation and strengthen the judgment by contemplation of cause and effect—the direct adaptation of means to an end so conclusively taught by the recurring seasons and the continuous round of animate and inanimate life must have incalculable effect upon the mentality.

SOUTHERN AGRICULTURE—MISSISSIPPI AND LOUISIANA.

PRODUCTION OF SOIL AREAS.

Prof. W. C. Stubbs, director of the Louisiana Experiment Station, began his address with a description of the geographical position of the States of Mississippi and Louisiana and said that one State is almost a reflex of the other, and the forces which produced soil areas placed on each side of the Mississippi River faithful counterparts. Louisiana has not yet reached maturity, for the Mississippi River is carrying to the Gulf and depositing soil material every year equal to over 1 mile square 300 feet deep. This river is gradually filling up the Gulf of Mexico and yearly extending the dominion of Louisiana. All of south Louisiana below Baton Rouge, known as the Delta Plain, with its immense fringe of coast marshes, is the outgrowth of the materials brought down by this great river. These recent additions to Louisiana have no counterpart in Mississippi, just as the earlier foundations in Mississippi find no corresponding representative in Louisiana. Agriculturally they are princely domains, Louisiana leading all States in the Union in the value per acre of products ($25), followed second by Mississippi with $19. Nature has blessed both States with a fertility of soil rarely equaled, never surpassed.

The speaker said that there were strangers present who might doubt the accuracy of such an assertion, and if so, he asked them to go with him over those States in a hasty examination of their resources, and he would guarantee conviction even though now surcharged with skepticism.

PRODUCTIVENESS OF THE MISSISSIPPI VALLEY.

Entering the mouth of the river they would find the far-famed valley of the Mississippi, with its numerous bayous, upon whose banks thousands of acres of sugar cane are grown annually, half a thousand central factories where the juice is converted into sugar, half a million people interested in the progress of this work, and half a million acres of the most fertile lands on the globe devoted to this crop, yielding over $25,000,000 annually. These lower alluvial lands are also well adapted to tropical fruits. Orange groves line the lower banks of the river, and thousands of acres of winter truck gardens and rice are to be found, giving support and comfort to many persons. Follow up these alluvial lands, go through the Red River valley of Louisiana, cross into the Ouachita, the Bouef, the Mason and the Tensas, of Louisiana, and the Deer Creek, the Sunflower, the Coldwater, and Yazoo bottoms of Mississippi, and everywhere will be found large and easily tilled plantations with palatial homes. To appreciate the nature and fertility of these soils, it is only necessary to watch the united waters of the streams hurrying past with a freight of sediment stolen from over a thousand townships. Take a glassful from yonder river and set it before you to settle, and you will find in the deposit a perfect museum of soils gathered from the fertile farms of New York and Pennsylvania, from the sandy cliffs of the great Kanawha, from the blue-grass regions of Kentucky and Tennessee, from the corn prairies of Iowa and Illinois, from the melon patches of the Cheyenne squaw, or from the canyons of the far-famed Yellowstone. Thus nature has robbed and is robbing the Northern and Western States of their finest soil material for the benefit of Louisiana and Mississippi. Under Southern skies these sediments, triturated, mixed, and deposited, make wonderfully productive soils. Louisiana has 20,000 and Mississippi 7,500 square miles of these soils, most of which can be made fit for cultivation under the present system of leveeing and drainage.

For rich alluvial soils, high above overflow, start at Baton Rouge and proceed continuously north until you have reached the city of Memphis; make frequent cross sections through this fertile belt, whose average width is about 40 miles, then cross the river into Louisiana, go to the Bayou Macon hills and follow them down to the Gulf; then turn westward into the Attakapas prairie, once the abode of Creole ponies and cows, now densely filled with the homes of many thousands of farmers and planters, like the soil they till, from a score of States congregated into villages, hamlets, and colonies.

Go into their fields and see how they have applied the mute instruments of human industry used in wheat farming to the more profitable cultivation of rice. You will see Iowa and Illinois reproduced, gilded by a glorious Southern sunshine. These prairies are fast becoming immense rice fields, and they are inundated by 260 miles of canal.

The speaker then suggested that perhaps his hearers would prefer to enter these States by land. If so, make a detour to the east and west of the Mississippi and proceed northward. There would be found inexhaustible forests of longleaf pine, dotted all over with steam sawmills, whose products reach by rail the treeless plains of the West and Rocky Mountain slopes and by water the States of Mexico and South and Central America. The last United States census estimated that there was nearly 50,000,000,000 feet of lumber in the forests of Mississippi and Louisiana.

Go farther north in both States until you reach the good uplands. There you will find well-tilled farms of red and gray lands owned and controlled by a sturdy and progressive yeomanry, where fountains of purest water gush from every hillside, and where fruits and vegetables are easily grown, and stock of every description cheaply raised. At Crystal Springs many girls are employed packing into crates the thousands of tomatoes and other vegetables which are shipped daily to western markets. Truck-growing on a large and profitable scale is fast monopolizing the attention of the farmers of this section adjacent to the great highways of travel.

Now go to northeast Mississippi, where there are immense stretches of cretaceous prairies with a variety of soils—black jack and bald prairies—all more or less calcareous clays of excellent fertility, bearing large crops of cotton; where the "melilotus alba" is preeminently at home, and where oats and hairy vetch furnish the finest winter pasture.

GREAT VARIETY OF PRODUCTIVE SOILS.

When you have finished this trip through these States you will have passed over a great variety of soils, each possessed of individual characteristics and at different elevations, yet all productive. The sections visited have the following areas: Alluvial lands, 20,000 square miles in Louisiana and 7,500 in Mississippi; bluff and brown loam, 5,793 in Louisiana and 8,200 in Mississippi; oak and hickory uplands, 8,103 in Louisiana and 5,830 in Mississippi; longleaf pine hills and flats, 10,138 in Louisiana and 14,800 in Mississippi; central prairie, 785 in Louisiana and 5,020 in Mississippi, and in Mississippi 5,990 in cretaceous prairies.

Such are the agricultural features of these States. Add to the fertility of the soil the numerous water courses and their railroad connections, insuring cheap transportation of all products, and their superb climatic conditions, and you have every requirement demanded by the modern tiller of the soil. These States grow almost every crop known to subtropical and temperate climates. Oranges, pomegranates, and figs

are grown extensively near the Gulf, while wheat, barley, and rye are grown in the northern sections of both States. Truck-growing is an enormous industry along the lines of the North and South railroads.

THE FINEST COTTON IN THE WORLD.

The speaker remarked that it was useless and perhaps saddening to many present to announce that these lands will grow cotton. Unfortunately, the low prices prevailing were a strong reminder of the fact that this crop is grown in too great quantities, but it may be of interest to know that in 1879 Issaquena County of Mississippi, Chicot County of Arkansas, and East Carroll of Louisiana, produced the largest acre products in cotton. These counties are in the Mississippi basin, and represent the intersection of three States, and at this point is located the center of maximum production of cotton in the world. The cotton grown in these valleys is for "elasticity, length, and strength of fiber," pronounced the finest in the world, and its high appreciation by English and eastern spinners is attested by the constant attendance of their buyers in our markets. Corn and rust-proof oats, planted at the proper time and in the proper manner, can be grown in large and profitable quantities in every county. Rice culture is successfully conducted wherever bayous and rivers furnish irrigation water. Grasses and clovers thrive under the summer sun and winter sunshine. Alfalfa in the alluvial lands is a great success, often yielding 6 to 8 cuttings per year. All the distinct types of tobacco are grown in these States. The yellow leaf, used for plug and smoking, on the hills; the cigar type, of excellent quality, on the bluff soils; and the peerless perique upon the alluvial lands. Fruit culture is practiced everywhere. Our figs, pomegranates, and pecans are famous the world over; while peaches, pears, and plums are grown largely for the market in the northern portions of these States. Ramie, our vegetable silk, can be raised in large quantities. Both varieties of jute and several varieties of hemp succeed well. Forage crops of almost every kind, yielding several cuttings each year, are grown extensively over these States. The conditions for stock raising are remarkably favorable, as there is an abundance of cheap food, a continuity of green crops throughout the year, and a bountiful supply of water.

TIMBER OF ALL KINDS.

The forests teem with timber of all kinds. Over 60 per cent of the forest wealth of the United States is situated in the South, and of this amount these States possess the lion's share. It is distributed along the tributaries of the Mississippi and the Gulf of Mexico, and can thus be cheaply delivered to the markets of the world. Millions of dollars have recently been invested in these lumber resources, and the sawmills and planing machines of the North, like the cotton mills, are gradually moving South for larger profits. In cypress timber we

stand without a rival, and our mills are putting annually upon the market nearly 500,000,000 feet of finished timber. Our oaks furnish an immense supply of staves annually to the foreign markets and our ash supplies the United States Navy, as well as the merchant marine, with oars. Our walnut, magnolia, beech, persimmon, gums, cottonwood, maple, etc., do or will supply many wooden-box or paper factories. Salt of the purest quality and in inexhaustible quantities has been found on the Five Islands off the Louisiana coast and elsewhere along the geological backbone of Mississippi. West of the salt deposits occur immense beds of gypsum and sulphur, together with flowing petroleum wells. Marls of high agricultural value have been found in many places in Mississippi.

Both States are blessed with thousands of miles of water courses, affording excellent facilities for getting our lumber and soils products to the outer world, and both States have an abundant supply of fish in the rivers, bayous, and Gulf.

But our largest natural resource is our location—situated on the Gulf, on both sides of the Mississippi River, connected by the latter inland with an immense territory stretching from the Appalachian to the Rocky Mountains and outward through its mouth with every port on the globe, it must be the gateway through which the exports of the entire valley, now populated with 30,000,000 people, must pass.

TOO MUCH LAND, TOO MANY MULES, AND TOO MUCH IGNORANT LABOR.

After this description of the agricultural advantages of these States, the speaker said:

But some of our Northern friends may ask why, with all this agricultural wealth, we are not prosperous and contented? The reply can be formulated in a single sentence: Too much land, too many mules, and too much ignorant labor. The latter, as hewers of wood and drawers of water, roustabouts on our steamboats, cotton pickers, and saw-mill hands, etc., are the best laborers in the world. As adjutants to the progressive, intelligent farmer, they are valuable; but as independent, progressive farmers and as growers of diversified crops they are as yet a failure and will be for some time to come.

With an excess of land, values are low, profits from hired unskilled labor uncertain. Cropping and renting, being a more certain revenue to those who hold large landed estates, are almost universally followed. Hence extensive planting of cotton, with acre yields rarely exceeding one-half of the natural capacity of the soil, and yet enough in the aggregate crop throughout the South to depress the price below the cost of production. As the negro is our laborer, so is the mule his constant companion at the plow. A hybrid, incapable of reproduction and unfit for the shambles, his only mission is to work and die. The losses incident to these two negative qualities in the use of the mule at the South aggregate in a year many millions of dollars. The mule must eventually go in any well-regulated system of farming. Our large estates must be disintegrated and divided, cotton must become a subordinate crop, and mortgages and deeds of trust obliterated from our public records ere the fullness of farming can be realized. We have reached the "parting of the ways," and must determine whether we will cling to old practices and become bankrupt or vigorously grasp the changed conditions of development and grow rich again.

EXPANSION IN THE FARMER AND THE FARMER IN EXPANSION.

AGRICULTURAL SCHOOLS.

Prof. William M. Beardshear, president Iowa State College of Agriculture and Mechanics Arts, in speaking on the subject of expansion in the farmer and the farmer in expansion, said in substance:

Science with practice in farming is recent not only in this country but in the world. The British National Board of Agriculture was not established until 1793, under the wise influence of William Pitt, the boy premier. The first three agricultural schools in the world's history, situated in Germany and Switzerland, were founded in 1799, just a hundred years ago. In this country agricultural education has its chief rise with the land-grant colleges of 1862. Yet the growth of these institutions has been most remarkable. The average farmer is liable to look at the college professor with his science as a kind of a strange animal coming down or rising up out of some mysterious region, and with it all impractical. Some of the professors have made mistakes on the other side, and have kept too great a distance from the practical needs of the farm furrows. They have not had their hearts enough in the work to make it plain and simple to the farmer of average intelligence.

SCIENTIFIC FARMING.

Dr. Jordan, of the New York Experiment Station at Geneva, employs a man to simplify the bulletins sent out by the various stations of the country so as to strip them of the unnecessary technicalities and make them understandable to the average population of the country. This is not peculiar to higher learning in agriculture. It is true in the development of all lines of new thought. But, on the other hand, too many farmers have talked too much about book farming and book learning and gone on in their old ways content to continue their backs to the light. These farmers have made the mistake of considering a few well-meaning yet stilted books, writers, and professors as excuses for excluding information and help from the realms of science. The college and the farm happily now understand each other better. Science is merely exact knowledge and sound sense. It is akin to the practical experiences of the intelligent man on his farm. Science is experience of the highest value. In the most progressive portions of our country through the growth of these recent years there are but few gaps left between the college and the farm.

As striking illustrations of the quickening and improvement of the implements of industry through cultured brains, the speaker cited the history of the evolution of the plow, and the invention of the cotton gin by Eli Whitney, a New England school teacher. He then said:

It remained for our country and Massachusetts to start the education of all classes, and the common-school system of the United States to lead the world in the leavening of the minds of the masses with the elements of education.

The most significant meaning of expansion to-day, not only in the farmer but among all classes, is that of the consistency and sympathy of education and labor. It is an accepted doctrine of long standing that the man who works with his brains and becomes a scholar is granted equal rank in society with the soldier, the men of state, of the professions, and wealth. A worthier acknowledgment is coming about in the world, which is that the man who works with his hands as well as with his brains, in accord with advanced industrial education of to-day, is entitled to first-rank admission among the best of the earth.

PROSPECTIVE SHORTAGE IN WHEAT SUPPLY OF THE WORLD.

The speaker referred to the marked sensation produced in scientific circles in England recently by the address of Sir William Crooks, president of the British Association for the Advancement of Science, who asserted that within the near future the world will be stared in the face with a grievous shortage in the wheat supply, and said that Mr. John Hyde, statistician of the United States Department of Agriculture, had made this address the basis of a very suggestive study of America and the wheat problem. Mr. Hyde makes a very thorough and substantial presentation of the wheat problem in the United States for the present and coming generation. By 1931, in the reasonable reach of the activities of the younger portion of this generation, the population of this country should be about 130,000,000 people. According to census reports this would, as Mr. Hyde says, make demands upon our resources—

to include a wheat crop of 700,000,000 bushels, without a bushel for export; an oat crop of 1,250,000,000 bushels; a corn crop of 3,450,000,000 bushels, and a hay crop of 100,000,000 tons, all for domestic consumption; with cotton and wool, fruit and vegetables, dairy and poultry products, meats, and innumerable minor commodities in corresponding proportions. The area necessary to the production of the three principal cereals alone will be over 15 per cent greater than the enormous total acreage devoted in 1898 to grain, cotton, and hay, while the mere addition of the two last-mentioned products and of the minor cereals will call for an acreage exceeding the total area of improved land in farms at the present time.

This could be overcome by growth in acreage of production. This growth in acreage in proportion to the inhabitants is already decreasing and will decrease much more rapidly in the next thirty years. Diversified farming will do much to help out these conditions, but this will not be sufficient to meet the demands. Scientific agriculture will come in as a significant factor in this remarkable calculation. All these considerations with reasonable certainty foretell the time within the reach of the present generation when the chief reliance must be upon the science of American farming.

Industry must be fortified with a superior intelligence, a skill wrought out on the farm, in the laboratories of the agricultural colleges and experiment stations, and the wise fostering of our national Department of Agriculture. This means a thoroughly enlightened farmer at the end of the next thirty years.

The spirit of expansion is not only in the air, but, better, it is in the

farmer himself. As a result of this expansion in the farmer, he will have better confidence in himself and in others than he has had in the past. Knowledge, science, and experience join interests to make man at home in all callings.

HIGHER EDUCATION FOR THE FARMER AND MECHANIC.

The speaker said that this expansion has brought higher education to the farmer and mechanic. The National Government has sixty-four colleges and universities devoted exclusively to the higher education of the young farmer and mechanic. From these the graduates in agriculture are now rapidly mounting by hundreds each year, and at the present time there are about 4,000 students in these institutions engaged in the higher education of agriculture. Of all the people having gainful occupations in our land, 36 per cent are farmers. One-third of the population and one-fourth of our national wealth are in the direct interests of agriculture. In one year the products of these farms amount to $2,460,000,000. A vast majority of this marvelous percentage of population is wholesome bodied and sound minded. They are the reservoirs of much of the physical, mental, and moral energies of the cities. They are the conservators of patriotism, industry, and thrift. They are just getting a taste of education applicable to their industries, their home, and their civilization.

AGRICULTURAL PUBLICATIONS ISSUED BY THE GOVERNMENT.

Of the value of the publications the speaker said:

In the past few years 6,663,000 farmers' bulletins of the most careful and scientific production and editing, and bearing upon practical questions of farm industry, have been distributed among the farmers of the United States.

A Yearbook, a superb volume of about 800 pages, brimful of practical matter to the farmer and with science adapted to his understanding, is issued free in an annual edition of 500,000 copies. The rate of increase in the publications of the United States Department of Agriculture has been so great during the last five years that if continued until 1901 the total number of copies will reach 16,000,000 and soon make it possible for the 5,500,000 farms in the United States to have immediate touch with this uplifting and inspiring information. In addition to this work of the Government, periodicals of State and national reputation are devoted exclusively to the various aspects of agricultural industry. The experiment stations of the various States and Territories issue annually about 450 bulletins treating upon the subjects of special scientific and local interest throughout the States. In addition to this an agricultural literature has sprung up in book lore that is finding its way to the more progressive farmers.

As effect follows cause, so surely will this beneficent aid of the Government and the universal intelligence of the American farmer bring a marked advance in all educational lines of his calling in the near future. * * * Daily rural mails, which are sure to come, good country roads, and in thickly populated districts of the United States electric railway connections will combine in the early decades ahead to speed education in agriculture and the intelligence of the farmer.

HORTICULTURE.

FRUITS AND OVERSTOCKING.

Hon. G. H. Van Houten, secretary of the Iowa State agricultural society, said that in its original meaning the word horticulture seemed to signify a garden, but in recent years it takes in not only the garden, but the small fruits, the orchard, and even the landscape, for we hear much of landscape gardening, and that one branch of horticulture has engaged the attention of some of our best writers.

The subject of horticulture is one that is inexhaustible. The changing conditions, the development, the different climatic conditions, the new varieties being propagated, the changing fashions—for fashions change in horticulture as well as in other things—render the study and practice of horticulture one of the progressive arts or sciences.

We learn from sacred history that horticulture was the first occupation of man. It is true that the first orchard was not planted by man, but he was commanded to dress and tend the garden.

During the many centuries when men were tearing down rather than building up, the fruits that must have grown on every hand were neglected and destroyed, and little but wild fruits remained.

Few localities are supplied with fruits of all kinds during the season, to say nothing about a home supply after the season of the particular fruit has passed.

It may be answered that prices are low and at times the markets have been overstocked. As a matter of fact, compared with the cost of production, prices for fruits have averaged above the prices of grain and stock. It is certainly true that the gluts in the markets are in a great measure due to faulty distribution. Fruits, more than any other products, must find a ready market, and must be disposed of soon after being received from the grower. With more systematic handling, cold storage, refrigerator methods of transportation, and more attention paid to finding markets there will be less overstocking, fewer losses, and more satisfaction to growers, dealers, and transportation companies.

The speaker said he did not assume to know the subject sufficiently well to deal with horticulture in all its different phases and for all of the territory represented by delegates to the meeting.

He would therefore not attempt to handle all the subtopics of the matter under discussion, but would speak from the standpoint of experience, more particularly as such experience had been gained in his own locality and in the fruits that do well in the State from which he came.

Apples.—Of all the fruits of the temperate zone none surpass the apple in importance. The varieties are almost without number, and are being constantly increased by scientific pollination. There are early and late varieties, so that with proper management fruit in its natural state can be had every day in the year. Not only can apples be kept

in the natural state, but they can be evaporated, dried, canned, preserved, and put up in various ways, to say nothing of the processes of expressing the juice and making it up into butters, etc.

In the Northwest generally too great a proportion of early varieties is planted. A selection should be made that will bring apples early, and then a succession during the entire season, with a goodly number of trees of long-keeping varieties to last over winter. It is not necessary to have cold storage for this, for caves are found to be an excellent and cheap means of keeping apples. If the caves are deep and with sub-earth ventilation the best results will be obtained and at small cost. If made of brick or stone or other substantial material they will last as long as required, but even if built of hard wood they will last many years. The great difficulty is to keep rats out of wood caves. Some good caves are made of concrete blocks or slabs, formed so as to make a cave shaped like a cone, with a door on one side with steps, and double doors to keep out the cold.

In the selection of varieties of apples for planting the safest rule that can be given is to plant those varieties that are known to succeed in the locality where you desire to plant, and especially on similar soils and exposures.

It is all right to experiment, and under conditions likely to prove beneficial, experimenting should be encouraged, but ordinary experiments are neither profitable nor educational, for the reason that they are not systematic and are not reported with such care and correctness as to be valuable. The experiment stations are better equipped for this work than the average individual and have better means of disseminating the results of the experiments.

Pears.—Pear growing has not proved successful generally in the North, and except in a few localities has not been a success with individuals. It may be that with the introduction of foreign varieties or by seedling production, varieties may be obtained that will thrive. Blight is the present cause of failure, and until nonblighting varieties are obtained the whole northland will import pears or go without. There is a great demand for pears, and if they can be supplied of a good quality at reasonable prices a good steady market is assured.

Peaches.—Peaches are grown successfully as far north as the forty-first parallel of latitude, and yet there are but few places so far north where they thrive and are anyways certain to produce a crop. Peach trees live and some of the hardier varieties bear as far north as north central Iowa, but some years, even in latitudes much farther south, and frequently over limited areas, the frost kills the buds and the trees fail to bear. Therefore, unless much hardier varieties are produced and more favorable conditions exist, there will be a demand for fruit, and those who live farther south will find a market for their peaches.

Apricots.—Some of the Russian varieties seem hardy enough to endure the rigors of climates as severe as that of central Iowa, but

little of this fruit is grown. The question of stocks for half-hardy and tender fruits has not received the attention it deserves. When it is taken up and studied it is quite probable that there will be a great increase of productiveness and fruitfulness. The question of adaptability of stocks to scions, or as it is often termed *congeniality*, is receiving a little attention and will receive more as we gain experience and have time to turn our attention to these more intricate matters in horticulture.

Plums.—None of the wild or native fruits of North America surpasses the plum in variety or excellence, and the American varieties can not be displaced by any of those introduced from Europe, Asia, and the islands of the sea. Foreign varieties may be larger and more showy, but they can not equal the native in quality. Their great variety, their excellence and their reliability leave little to be desired in the way of season and quality, and some of the newer varieties propagated by enthusiastic growers are approaching in size the foreign varieties. The plum, unlike other native fruits, has a wide area, and endures the heat of the South and the cold of the North, so that native varieties can be found that will meet the requirements of any special locality from the Great Lakes of the North to the Gulf of Mexico. The Chicasa varieties are not as desirable for the North as those known as *Americana* varieties.

Crosses and hybrids of the native plums and varieties from Europe, and more particularly from Japan, are so promising that many active experimenters are giving considerable attention to this branch of horticultural work. No matter how good the quality of a fruit may be, if the size is small there will be a demand for something larger. This opens up a field for experiment, and encouragement should be given to those who desire to produce new varieties.

Cherries.—Unlike plums, the native cherries of North America have never become popular, and yet it may be found necessary to use the *Prunus pennsylvanica* as a stock for the red cherries of Europe. Experiments along this line indicate that it will pay to do so. There is a long list of varieties, and the range of size, season, and quality enables the planter to make a choice with the hope of getting just what he desires. Some of the varieties are not hardy enough for the north, but there are many that are hardy and of good quality. Others do well farther south, so that varieties may be found suited to the especial requirements of the planter and the place in any given locality. The cherry is becoming one of the popular market fruits, and many large orchards are being planted, so that it is safe to assume that there will be a large increase in this palatable fruit. The speaker has not given up hope of getting something good in cherries from Japan. The cherry is one of the most popular, if not the most popular, tree for park planting in Japan. The trees are hardy, grow to large size, and afford a season and variety of bloom that is surprising. If the importations

do not give us what we want, then seedlings should be planted or crosses procured so that we may try to get some of the desirable characteristics of the Japanese varieties. This is a field for experiment that has not received the attention it deserves.

The speaker said:

The plums in Japan have a season and variety of bloom that is perfectly astonishing, and the fact that the fruits in Japan stand quite hard freezing when in bloom seems rather strange when we consider that the weak point in growing such fruits in the United States is from the supposed tenderness of the bloom. In Japan for days and nights together I have seen ice form to a considerable thickness, and yet the tree blooms seemed to endure it without injury. In the United States we always hear that the Japan plums fail because of spring frosts.

Time will not permit me to discuss all of the fruits that will do well in even a given locality, but the growing importance of at least one of the small fruits induces me to name one in this connection.

Strawberries.—Inasmuch as the strawberry is easily grown, that it can be grown almost anywhere, that there is scarcely any limit to the distance it can be shipped by rail, and that the seasons are such as to encourage the growing of the fruit in one climate to supply it in a fresh state to persons living in other climates, make it one of the most popular and profitable market fruits.

There are localities that ship hundreds of carloads of berries during a season, and some of them are greatly increasing their acreage. In the busy season in Missouri ten thousand pickers may be seen at work in one locality and the berries going out by the carload.

Texas, Florida, Mississippi, and other States south begin in the winter to ship berries north, and as the season advances the growers farther north begin to supply the demand, and as the sun advances toward the north the berries ripen, until in the summer time the Northland comes up with its crop of this delicious fruit. Strawberries grow even as far away to the north as Alaska. With the many good varieties any given locality can be supplied with this splendid fruit.

What has been said of strawberries can be said to a less extent of raspberries, currants, gooseberries, blackberries, and other small fruits.

BAMBOO.

The day will come when all of our Southland will grow the bamboo. Travelers in the far East, and especially in Japan, are impressed with the importance of the bamboo. It is used for almost everything, and is profitably used too. It can be grown so easily and in such profusion that when we begin to study economy, as we must some time, we will raise bamboo in all localities where it will grow. It thrives wonderfully well as far north as central Japan, and we are led to believe that it will thrive in the Southern States as far north as Tennessee. It grows to considerable size even as far north as the latitude of southern Iowa, but Iowa winters are too severe for it.

It would flourish in the South, and it is susceptible of so many and such varied uses that it must be seen and utilized to be fully appreciated.

AGRICULTURAL EDUCATION.

ENDOWMENT OF AGRICULTURAL COLLEGES.

Agricultural education was the topic discussed by Prof. William M. Liggett, dean of the College and School of Agriculture of the University of Minnesota. He referred to the passage in 1862 of the bill introduced by the late Senator Morrill and passed by Congress, granting 11,000,000 acres of the public domain for the purpose of endowing an agricultural college in each State in the Union; the passage in 1890 of the so-called Morrill bill making appropriations from the sale of public lands to supplement the income from the original grant; the liberal appropriations from State treasuries for buildings, equipment, and running expenses, and said:

> With such endowments it is not unreasonable for the public to look for results, and to be disappointed when Senator Morrill's dream of the practical school of agriculture did not rapidly materialize.
>
> The evolution of the now popular idea of practical courses of study in agricultural schools has been slow. Half a century ago all school methods tallied with the idea that learning was for the few. The modern idea is to diffuse knowledge and give rich and poor equal opportunities for individual development and advancement. This is in such close accord with American sentiment and theory of American government that it only needed to be proposed to be generally adopted.
>
> Now, the States have opened all doors, from the district schools to the university, on the theory that ignorance is the enemy of the state and a menace to popular government.

It is unfortunate that the swift movement toward popular education was not quickly followed by a radical revision of school methods. The old machinery made to grind out doctors, lawyers, and preachers has continued too long and the grist has been a disappointment.

The city has grown at the expense of the country. The brightest young people have left the farms, the standard of country living has been lowered, and the professions have become so overcrowded that the surplus is a burden to society. But common sense has been too strong for old traditions, and it is now generally admitted that if education is to be universal, or even general, it must be along practical lines, and that school is counted the best which, while developing a well-rounded character, best fits the student for his chosen calling.

To be successful a school of agriculture must command the respect and approval of those most interested in the work, and with a school planned and conducted on right lines the problem how best to extend its usefulness is greatly simplified.

MODERN IDEA OF PRACTICAL FARM EDUCATION.

The speaker said that by way of illustration he would refer to some phases of experience in the Minnesota School of Agriculture as a fair embodiment of the modern idea of practical farm education. This school was among the first to adopt a practical course of study and

practical methods of instruction. A very large percentage of the graduates follow agricultural pursuits, and the people of Minnesota are well-nigh unanimous in its support. Its success in these particulars is phenomenal and worthy of careful study.

The foundations of the school were carefully laid along practical lines. The location chosen was the State Experiment Station, where during the entire year the teaching force carry on actual experiment work and gather material for use in their no less important capacity as teachers in the winter school. This close alliance of the school and the station is a strong point, and as the station is near the university (of which the School of Agriculture is a department), the fine equipment of that liberally supported institution is always at command for the use of both students and faculty. As the prospective students would be from the farm, the sessions were made in winter, the season of comparative leisure in the country. Dormitories were built calculated to bring the students in closer touch with the faculty and teaching force; and to create a school home and home life, a liberal table was provided at cost; a simple gymnasium was provided, and military drill and physical culture required.

The course of study aims to supplement what the student already knows, and at the same time to thoroughly cover all lines of agricultural work.

Thoroughly practical methods of teaching are followed, and the aim is to teach the one best way of doing a thing and clinch the lesson by giving the reason for it, thus training the mind of the student to search for those fundamental principles which, in the future, will be needed to direct him in the conduct of independent investigations.

In the side lines that bear a close relation to farming enough is taught for practical use. In blacksmithing the student learns to make all ordinary repairs to farm implements. In carpentry he is taught the use of tools and how to construct ordinary farm buildings. In horticulture the management of the farm garden is completely covered. In dairying the student follows the whole process of butter and cheese making from the cow to the completed product ready for shipment, and learns the use of every implement employed. In entomology he learns to know insect friends and enemies, and how to protect one and destroy the other. In chemistry he learns the composition and values of the feed which his live stock consumes, and how to analyze the soil he tills. In botany he learns the laws which govern plant growth, and gets the key to the best methods of culture. In the veterinary class he learns how to treat the common diseases of domestic animals and something of simple surgery, and in the broader study of agricultural work the best method of culture and use of farm implements. In live stock, judging animals is thoroughly taught, and the science of feeding is made an exhaustive study. Slaughtering animals and cutting and curing of meats is explained to an extent covering the needs of an

ordinary farm. All these lessons are clinched by actual work. The student is not only told how to do things, but is required to do them under the eye of a careful and intelligent instructor.

METHODS OF TEACHING.

The speaker said that, as an illustration of the methods of teaching, a class in live stock might be mentioned. A cow, for example, is brought in. Many students when they reach the school think they know all about cows and need no introduction to them. But when the cow before the class is analyzed, her faults shown, her good points made known, and the ideal cow made plain to the mind's eye, a new interest is aroused, and when later the student is required to judge a different one, applying for himself the principles taught, the practical lesson is fixed in memory beyond any probability of losing it. And when he is led on into the science of feeding and learns that kindness, comfort, and shelter pay, and that feed not needed is worse than wasted, and that want of a properly balanced ration is partial starvation, he begins to understand that he knew a very little about cows, and what was perhaps distasteful before takes on a new and intense interest.

The same line of instruction is followed in other departments. The lessons taught in all the class rooms are so clearly practical and valuable that it is seldom that an experienced farmer visits the school without saying, "If I could have had such instruction when I was a young man it would have saved me thousands of dollars."

But, however wisely the foundations of a school are laid, its success depends upon its teaching force. That of the Minnesota School of Agriculture is a harmonious body, working together for the single purpose of winning success for the school, and each member is an expert and an enthusiast in his or her line and in full sympathy with rural life.

It is of no use to have instructors to teach young people what they do not believe themselves, and the best teachers are enthusiasts who can inspire everyone around them with something of their own sentiment.

THE SCHOOL MUST KEEP IN CLOSE TOUCH WITH THE FARMER.

The school of agriculture which expects to grow in attendance and influence must keep in close touch with the intelligent and progressive farmers of the State. No dean or professor is so wise or well equipped that he can not learn something from the men who walk between the handles of the plow and put all theories to the test of actual practice. It is a pleasure to acknowledge that many of the most practical features of the course of study at the Minnesota school are based upon suggestions from farmers whose wisdom came from the fields.

TO CHECK THE TENDENCY CITYWARD.

Whether schools of agriculture will check the migration of the bright young men and women from the farms to the cities remains to be seen. It is not expected, nor is it desirable, that all graduates of these schools should remain on the farm. Some are unfitted to be farmers, and if such choose a calling that is distasteful to them the calling is discredited and the individual is hampered by an uncongenial employment. To check the tendency cityward, schools of agriculture should present the attractions of the country in new and favorable lights, so that the substantial advantages of rural life will not suffer by comparison with the more brilliant but illusive attractions of the city. All the systems of education, including the country school, have in the past educated children away from the country. One of the missions of the school of agriculture is to make the country home stand in its true relation to wholesome living, and to enable young people to decide fairly and intelligently between the country and the city.

Fortunately the students in these schools are good material to begin with, and most of them are studious, ambitious, and self-reliant.

What an uplifting force will be developed out of these centers of influence as the graduates year after year assume their duties as citizens and found new homes can hardly be imagined, but that it will be a powerful factor in placing agriculture in the front rank of industrial progress does not admit of a doubt. For myself, I look forward to the future of schools of agriculture with a confidence which I believe is fully warranted by the success already achieved, and expect to see their influence steadily increase and widen until the effect of their good work becomes more and more apparent in the betterment of conditions on the American farm and the general uplifting of this the most important class of the world's workers.

STOCKS AND FEEDS TO FEED THEM.

LOSING MONEY GROWING COTTON.

Prof. W. C. Welborn, of the Agricultural and Mechanical College, Mississippi, said he attended a farmers' institute last summer in one of the hill counties of Mississippi, where, like all other parts of the State, the people depend on planting enough cotton to buy money or credit enough to buy a living with. He wrote down all the items of expense incurred in growing cotton, from the preparation of the land to the marketing of the crop and farmers present filled in the figures. The average yield in the county was one-third of a bale per acre and the expense footed up $12. The cotton and seed at the prices then prevailing amounted to $9.35, making a net loss of $2.65 on every acre of land growing cotton.

A few days before the present convention he was at a large farmers' meeting at Magnolia, Miss., where the people were earnestly asking what they should do to be saved from bankruptcy. He repeated the inquiry as to the cost of growing the great staple at the rate of yield there prevailing, which was likewise one-third of a bale per acre. The

expense column footed up $10.85. Deducting from this the value of the crop, the net loss was found to be $1.50 per acre, or $4.50 per bale, on all cotton raised in Pike County. At this same meeting it was shown that a bale of cotton per acre would give a profit of $11.35, but the people said they could not make a bale of cotton per acre except on a favored spot now and then—that they could not make it even with a large amount of purchased fertilizer.

Only small applications of concentrated manures are found profitable. From long-continued cultivation in cotton, the land has lost its life-giving vegetable matter, or humus. It will not hold enough water to supply the yield of crops that large applications of fertilizers should give. The land needs a rotation of crops, including leguminous crops and pasture grasses, and should be devoted to the live-stock industry, instead of cotton, the lint and seed of which are shipped to distant States and countries.

For the benefit of those persons who think that the agriculture of the State is diversified enough, the speaker said that of the crops grown in Mississippi in 1898, the value of which he had roughly estimated at $50,000,000, he could not find in any statistics at command enough crops other than corn and cotton to make $5,000,000 in value. With a climate and soil admirably adapted to hay grasses and forage crops, Mississippi raised in 1890 less than 100,000 tons of hay; with the finest land on the globe for fruits and vegetables, she produced less than $250,000 worth; and with the far-famed cowpea, the clover of the South, the easiest of all crops to grow, the greatest fertilizer ever given to man, a stock food second to none on earth, but 240,000 bushels had been grown that year, when 10,000,000 bushels should be grown.

MISSISSIPPI AND IOWA PRODUCTIONS COMPARED.

He said that in order to get at the truth of the matter as to whether Mississippi is as prosperous as she should be, he would briefly compare that State with one of the Northern States having a smaller agricultural population.

In 1890 Iowa farmers worked 25,000,000 acres of land; Mississippi farmers, greater in number, worked but 7,000,000 acres.

If Mississippi raised $50,000,000 worth of field crops last year, Iowa, as estimated, raised no less than $120,000,000 worth. In 1890 Iowa produced 500,000,000 gallons of milk, worth $40,000,000, as compared with $4,000,000 in Mississippi. The people of Iowa in 1890 had in round numbers 22,000,000 fowls, laying eggs valued at $7,000,000. Mississippi had 6,000,000 fowls, laying $1,000,000 worth of eggs. The statistics available did not give the annual supplies of pork, beef, mutton, etc., for slaughter, half of whose value no doubt came from pastures the product of which were not otherwise enumerated. Considering these items the conclusion is irresistible that each Iowa farmer's income is three times that of the Mississippi farmer.

In 1896 the people of Mississippi owned 291,000 milch cows worth less than $13 each, and 446,000 other cattle worth $8 a head. Iowa people owned 1,200,000 milch cows worth $28.50 each and 2,200,000 other cattle worth $25 a head. Mississippi's 2,000,000 razor-back hogs were worth $2.40 each, while Iowa's 3,750,000 hogs were worth $6.

Of hogs, cattle, and sheep Mississippi has $12,000,000 worth and Iowa $112,000,000 worth, or nearly nine and one-half times as many. Who can wonder that Iowa's per capita wealth is $1,200, while Mississippi's is but $350, and the total wealth of the former State is five times that of the latter?

MIXED HUSBANDRY AND DIVERSIFIED AGRICULTURE.

The speaker said he believed that mixed husbandry and diversified agriculture, in which enough stock is kept to consume most of the products of the farm, are largely responsible for the excellent showing made by the Northern sister State as compared with his own State. In Mississippi a system of ill-advised, badly balanced, lopsided farming is followed that enables a hand to wear out about 15 acres at a time.

They now grow mostly a crop requiring an immense amount of human labor, the most expensive factor that enters into any business. The culture of cotton, allowing the land to remain bare all winter, has so facilitated washing and leaching of the soil during open winters as to well-nigh ruin much of the best land God ever gave to any people.

Much of the land has become so infertile and the price of cotton so low on account of too exclusive culture that landowners can not make day laborers' wages for themselves and families while growing it. Necessity is moving the people as never before to find new crops and new products to divert some of the labor and utilize the lands. A better-balanced system of agriculture is needed—one that will include more crops to enrich instead of wear out the lands; one that will include more live stock to consume the products and manure to still further enrich the soil. Such a system, if intelligently planned, will enable each farmer to profitably utilize 3 acres where he now loses money on 1.

ROTATION OF CROPS.

By a suitable rotation of cotton, corn, and peas, oats and peas, hay grasses and pasture, every acre of run-down farms might in a few years have its producing capacity more than doubled. With plenty of stock, feed stuffs may be grown on the least desirable parts of the farms and fed on the most desirable, and thus have the fertility moved, in a measure, to where it is wanted.

From the earliest times it has been known that one crop would in some way prepare the land for making another crop. In the light of modern science it is now quite well known that certain plants draw on the atmosphere for definite quantities of nitrogen whose compounds make our most nutritious feed stuffs and our richest fertilizers, and the

amount and value of which may be computed as accurately as may be the value of a bale of cotton or a load of corn.

WHAT WAS RAISED AT THE LOUISIANA EXPERIMENT STATION.

Dr. Stubbs tells us in a bulletin soon to be issued from the Louisiana station that an acre of Spanish peanuts grown on poor pine lands at Calhoun, La., contained 192 pounds of this nitrogen, worth at commercial fertilizer's value at least $25. An acre of velvet beans contained 191 pounds, and an acre of cowpeas 108 pounds. These crops made from two to three and a half tons of feed stuffs richer in food elements than wheat bran. When they can be fed to stock without serious loss of fertilizing value is there any excuse for having poor land and poorer stock? Professor Duggar, at the Alabama Station, found an acre of Spanish peanuts on poor gravelly land produced 600 pounds of live weight of hogs, and an acre of cowpeas about 400 pounds. No country on earth has such advantages for growing restorative forage crops, and yet no country makes so little use of them. By a simple rotation of crops, with a very moderate application of mineral fertilizers, the poorest farm in the State may soon be built up to where it will produce 40 bushels of corn or a bale of cotton with as much ease and certainty as the great Yazoo Delta. Dr. Stubbs did this at Calhoun, La., on land showing by analysis extreme poverty.

By rotating cotton, corn, and peas, and oats followed by peas the same season, he brought the cotton up to a bale and over, the corn yield to 37 bushels, and the oats in one case to over 60 bushels, and pea-vine hay to 2 tons. To inaugurate such a practice it is only necessary to divide the farm into three parts, plant the three crops, and let them follow each other in the order named. This could be practiced by every farmer, however poor. Such a plan would in a few years regenerate the worn lands to where the one-third of the farm planted in cotton would yield as much as the two-thirds or three-fourths in cotton now yields, the expense would be cut in half, and the profits would become real. With two-thirds or more of the farm in food crops, and with live stock to consume it, they would naturally find it convenient to provide ample pastures and broad meadows, and thus would they find another profitable means of reducing the cotton acreage. Then would one hand in Mississippi utilize as much land as a hand in Iowa, and the income be multiplied by three and the land quadrupled in value.

Under a system of rotation with the legumes the poorer lands of Mississippi would need only acid phosphate, and by the use of acid phosphate on these lands the yield of peas would be doubled, and thus twice the amount of nitrogen would be drawn from the air.

Even better results can be obtained in the way of feeding lands and live stock at the same time than has been indicated. Mississippi has more than one winter-growing legume that will prove an entire success

for every part of the State. Scientists have demonstrated that the germs that enable certain crops to feed on nitrogen from the air can live and work and grow all of the southern mild winter.

The professor said that on the 10th of February, just one year ago, he picked a square yard of bur clover and had it weighed and analyzed. Calculated to an acre, the above-ground portions contained as much nitrogen as 1,000 pounds of cotton-seed meal would furnish and enough dry food to support a thousand-pound cow eighty days. An experiment with hairy vetch showed as much nitrogen as 1,100 pounds of cotton-seed meal would furnish and enough dry matter to feed a cow one hundred and thirty days.

GROWING LIVE STOCK.

The professor said:

We can keep our lands busy twelve months in the year growing fertilizers and feed crops. We can grow the fertilizers in winter for our regular spring crops and feed our stock to boot. As to whether we can grow as fine cattle as the North, there is considerable doubt in the minds of some of our people; but I have no doubt, in fact I know we can do it. For some years we have grown hogs to weigh 200 pounds at six months with an ease and cheapness you know not of in the North. Our green winter crops we find make from one-half to three-quarters of the food of hogs and cost nothing. Our people are everywhere admitting now that we can raise the hogs, but there is yet doubt about raising a large, quick-maturing, high-priced steer. But this can be done. Last fall we weighed a number of spring calves that had run with their mothers, and there was not one that did not grow 2 pounds a day or more all through the summer. I wrote to a number of St. Louis and Chicago live stock commission companies and asked them what good, well-marked, grade Hereford, Shorthorn, or Aberdeen Angus calves, eight months old and weighing 500 pounds, would bring in those markets November 15, when the quarantine against our cattle is raised. They invariably replied, if they show good blood, they will bring a round 5 cents a pound to go to the farms as feeders. Just think of it! An eight-months old calf bringing $25. Why, our two-year olds, the way we grow them, bring $5 and $6 a head.

CROPS AT THE COLLEGE FARM.

The speaker said that on the college farm the whole face of the earth is covered with green crops, principally turf oats and hairy vetch. When once started these crops never have to be resown, and the vetch is whipping the oats out, taking field after field. About 500 acres are clothed in green. Green crops keep the lands from washing and leaching during the warm, wet winters, as these causes have done five times as much to wear out the lands as all the crops ever removed from them. These crops are being sown between the rows of corn, cotton, sorghum, peas, etc., at laying by time. If every cultivated acre were so treated in Mississippi, and the resources for growing food fully developed, she could grow the beef of Iowa, the dairy products of Wisconsin, the pork of Illinois, and the mutton and wool of Ohio.

A great deal of sorghum was planted about August 1 to 10 last year on land made rich by vetch. From August 1 to November 1,

between the first frost of Minnesota and that in Mississippi, as high as 23 tons of green sorghum per acre were grown, curing out as high as 5 tons of hay-dry forage, making 8 or 9 tons of juicy hay ready to stack or house. Most of this sorghum crop was put in the silo just after the first freeze—November 1. The cost of the sorghum silage, from breaking land, buying seed, and hauling the cane an average of 1½ miles, was 50 cents a ton. Some of the crop was cut for hay and allowed to lie one week, drying out enough not to sour after it was stacked and housed. The speaker said that he never saw better hay; stock eat every shred of it. In fact, when he left home a week ago it was as sweet as sugar and juicy enough to chew. When cut late it will remain succulent all winter, and does away with the necessity for a silo. Grown as a second crop, it need not cost $1.50 per ton to grow this splendid hay. It will lie a month in the usual dry November, and will stack better than any other hay.

VARIETIES OF HAY CAN BE GROWN.

Hairy vetch, or turf oats and hairy vetch mixed, cut for hay about May 15, make a hay not inferior to red clover or alfalfa. Early varieties of cowpeas will make a crop of hay in two months. By following vetch hay with early cowpeas for hay the land can be ready for sorghum hay by August 1 to 10, and if 10 tons to the acre is not grown there will be nearly that much. Thus for nine months in the year crops that draw nitrogen from the air will be grown, and much of it will be stored in the roots and stubble and in the adjacent lands. In three months it will be pumped out by that grossest of all feeding stocks, the sorghum, and fed to stock.

In conclusion, the speaker said that he believed that with the help of such meetings, with the help of the stations and colleges, and with the help of the Department publications, which are indipensable to him, that they would work out their great industrial problems.

THE PECULIAR ADVANTAGES OF THE SOUTH FOR GROWING FORAGE CROPS AND FEEDING STOCK.

POSSIBILITY OF RAISING HIGH-GRADE ANIMALS IN THE SOUTH.

Prof. W. R. Dodson, botanist of the Agricultural and Mechanical College of Louisiana, said that other speakers had told how to select animals and how to breed them; the nature of the food and how it should be fed; and the care stock should receive, and the results that should be obtained. It remained for him to tell that all this can and should be done most successfully in the South, especially in the States of Mississippi and Louisiana. He would devote the time allotted to him to a brief discussion of three questions:

1. The possibility of raising high-grade animals in the South.

2. The advantages in the way of cheap feed and the economy in the care of stock.

3. The question of marketing.

The South has never produced even its own supply of meat, horse power, or dairy products, and has been largely dependent upon the States North for mules and horses to perform plantation work. Enormous quantities of salt pork, bacon, and beef have been imported annually. Kansas and Nebraska furnish a large portion of the butter used. The beautiful horses that prance on the streets are nearly all brought from other States.

The speaker asked why this state of things should exist. He believed that these animals could be reared from birth within the confines of the Southern States.

Horses brought from other sections suffer but little inconvenience in becoming accustomed to the climate, and mules know but few ailments. There is no reason why hogs can not be raised in the South. Less than two weeks ago a dressed hog was sold at the Baton Rouge market which tipped the scale at 800 pounds. This shows that hogs can be raised in the South to any size desired. They are robust and healthy and all breeds find a congenial home.

RAISING CATTLE FOR BEEF OR DAIRY PURPOSES.

The raising of cattle for beef or dairy purposes is a more serious question. There are some obstacles in the way, but they are not insurmountable. Northern-bred animals imported for the purpose of improving herds are subject to Texas fever, which is very fatal to adults. The great losses from the disease has perhaps more than anything else discouraged the improvement of stock in the South. As is well known the Southern cattle tick is the conveyor of this dread malady and is the only means known for the transmission of the disease. It has been demonstrated that pastures can be freed from the tick by not allowing cattle to run on the land for one year. A large percentage of young animals recover from the disease without treatment and from these it is possible to build up immune herds. There also appears to be a fair promise that the fever may be prevented by protective serum inoculation.

The speaker said he believed that when the roaming at large of cattle ceased in the South the tick question will become far less formidable as an obstacle to successful stock raising. He concluded his discussion of the first question with the assertion that the careful, intelligent, and diligent stock raiser need not suffer any loss from Texas fever, and that the best blooded horses, hogs, and cattle can be raised in the South.

ADVANTAGES FOR ECONOMICAL AND PROFITABLE FEEDING.

Now for the second question: What advantages for economical and profitable feeding are afforded?

Every intelligent feeder recognizes the necessity of having what is called a well-balanced ration; that he must mix the components of the feed according to the results that are desired. If feeding for milk and butter, there must be a certain ratio of carbohydrates to proteids, etc. There must be a different ratio when feeding for beef or for growth of young animals. The best results are obtained when a particular quantity of concentrates is mixed with a certain amount of roughage or hay.

It matters not how good a food a plant may make, it is not desirable unless it can be raised cheaply. For carbohydrates in the way of concentrates, the South has corn, oats, sorghum seeds, grass hay, etc., about the same as the North, and in addition the by-products of the rice mills and sugarhouses.

From observation and from available statistics the speaker believed that the land in the South will produce as much corn per acre as will the average land in any other portion of the United States.

It is true that there are some very poor, cotton-worn soils, but there are also vast quantities of territory that are extremely fertile. The cost of production is slightly greater than in the North and West, simply because improved agricultural implements have not come into extensive general use. Improved farm implements in the hands of intelligent white men will bring down the price of corn to what it is in the so-called corn States. But the South is not dependent on corn alone for highly concentrated carbohydrates.

Rice bran and rice polish, by-products from the rice mills, form excellent feed, comparing favorably with corn. A ton of rice bran contains approximately 240 pounds of protein. A ton of corn contains only 194 pounds, a difference of 25 per cent in favor of rice bran. On the other hand, corn contains 21 per cent more carbohydrates. Rice bran is quoted at $8.50 per ton. This would represent corn at about 25 cents per bushel. But as it is a by-product, its price will vary with the price of corn, for which it more nearly serves as a substitute.

PROTEIN CONCENTRATES.

Now, how is it with regard to the supply of protein concentrates? In the North wheat bran is the bountiful supply of highly protein feed. Cotton-seed meal takes its place in the South. Wheat bran contains about 15 per cent of protein and cotton-seed meal 42 per cent, or nearly three times as much as bran. When the enormous output of this product is considered it at once becomes evident that the South can furnish an abundant supply of the protein feed. It is highly esteemed for all animals except hogs, and large quantities are shipped North, where it is regarded as a valuable feed.

COTTON SEED.

The South produces about four and one-half million tons of cotton seed. A good percentage is returned to the soils as raw-seed fertilizer.

A large part of the remainder has the oil extracted, and is then applied in the form of meal to the land whence it came, or to the land of some other farmer more thrifty and wise. A great deal is exported, and a comparatively small quantity is fed either as seed or meal on the farms where it is raised.

Science has done great service in revealing the value of this enormous product, but the South yet lacks one important step in following the teaching of science. This material should be fed to stock and the fertilizer should be saved and applied in the form of barnyard manure instead of applying it as raw material, provided its use can be supplemented by other things that can be grown to advantage.

FORAGE CROPS.

The speaker then began the discussion of forage crops. He said he had not claimed that the South had any material advantage in the production of concentrated feeds, but he believed it could stand on a par with any other section in this respect, while in the way of forage crops he would attempt to show that the climate gave it many advantages. Timothy, clover, red top, and oats are some of the best crops of the sections that raise the greater portion of high-bred animals. Timothy yields from 1 to 2 tons per acre, and one crop a year. The hay is poor in protein, containing less than corn in proportion to carbohydrates, and would therefore not be the best hay to combine with the cheaper starch feed stuffs. Clover yields slightly heavier crops, and is probably the best combination hay the South can raise. Its protein content is very high and is very desirable to combine with corn or other concentrates containing a high percentage of carbohydrates. Clover sometimes yields two cuttings a year, a hay crop and seed crop. The clover is the favorite hay and forage crop with many farmers, and if comparisons are made with the clover no one can justly object. Take the cowpea, the favorite of the South, and compare it with clover. It produces almost twice as much hay per acre. Cowpeas yield from 2 to 4 tons, while clover produces from 1 to 2 tons. A ton of clover contains about 206 pounds of protein and 760 pounds of nitrogen-free extract, and a ton of cowpea hay 332 pounds of protein and 844 pounds of nitrogen—a difference of 126 pounds protein and 84 pounds nitrogen in favor of the cowpea hay. It requires the use of the land for a year to produce a crop of clover and but from three to five months to mature a crop of cowpeas. In the South the farmer can easily raise a spring crop, plant cowpeas in June or July, and harvest a crop of fine hay in October. He then can sow oats, rye, barley, vetches, or crimson clover and have a winter pasture that will surpass anything that can be found in the North. This will of course require more labor and more expense, but the profits will come oftener.

Corn can be raised with cowpeas sown between the rows, and more hay can thus be raised than clover will produce when clover does its

best. The corn and peas can be harvested, oats can be sown, harvested in the spring, more cowpeas sown and crop harvested before frost, making two crops each year.

Then, when we can raise more stuff to the acre, more crops in a given period of time, each richer in food value than the crops of the North, is it not very evident that we have very material advantages for stock raising? These crops will also make our soils richer, gathering nitrogen from the air and adding it to the soil.

The cowpea is not the only crop rich in protein that is raised in the South. It is simply the summer crop. Vetches and clovers are good winter crops and alfalfa is good for all the year. It furnishes from five to seven cuttings on the alluvial lands, and it probably does as well in the South as anywhere on the continent.

Lespedeza or Japan clover is well adapted for the poor hills, and produces as much hay as clover does on good soils in the North, but produces but one crop a year.

The speaker thought that he had shown that the South can obtain bountiful yields of highly nutritive forage, and that the production of these crops is less expensive than in the North on account of the increased number of crops and less capital required to get a given return.

PASTURING FACILITIES.

When pasturing facilities are compared, the advantage is still greater in favor of the South. While the Northern farmer is compelled to provide expensive houses to protect his animals from sleet, snow, and the cold northern winds, a simple shed affords ample winter protection in the South. There is also an ample supply of pure water.

There is practically no season of the year when there can not be a plenty of green forage, and while the cattle in the North are shivering in the cold and rooting in the snow for sprigs of winter grasses the Southern herds may be grazing on green winter pastures. In the North pasturing practically closes in November and opens May 1. Each year the pasture grass is very scarce, and during this time the animals are almost entirely dependent upon the harvested foods.

OVERPRODUCTION.

The question may be asked, that if this is all true why the farmers do not make use of their opportunity. The answer is that it has not been necessary. Until recently cotton, cane, and rice have been profitable, and the planter has been content to raise these money crops, which always find a quick cash sale anywhere. He has clung to them year after year hoping for better prices, losing year after year, and now he is financially unable to break away from the credit system and devote his farm to stock. But the time for large profits on cotton, cane, and rice has passed away; the cry of hard times is heard on every hand, and the low price of cotton is the topic discussed by every Southern planter. It is not a case of famine or crop failure, but overproduction.

The sooner the Southern farmer quits the one crop system and resorts

to diversified farming and stock raising the sooner he will begin to prosper. He should raise his own animals, feed them from his own fields, gather the manurial fertilizers and return them to further enrich the soil.

MARKET FOR SOUTHERN STOCK.

The question of a market for Southern stock will solve itself. When the conditions will justify it, packing houses will be established in the accessible Southern cities, and the embargo now placed on shipment to Northern markets will not cause trouble.

The speaker said he believed there is a profit to the small capitalist and money to be made by the large capitalist in raising cattle, hogs, horses, mules, and sheep in the Southern States.

THE WEATHER BUREAU AND THE FARMER.

RAIN FORECASTS.

Prof. Willis L. Moore, Chief of the Weather Bureau, said that while the greatest element of error in the work of the Bureau is in the making of rain forecasts, yet these predictions greatly benefit the agriculturist. Owing to the peculiar topography of California and its proximity to the ocean, and to the fact that storm conditions universally travel from the west, the Bureau is able to make rain predictions of great value to the farmers in that section. The value of the orange crop averages about $5,000,000 per annum; of the raisin crop about $3,000,000. Raisins are cured in the sun, and are subject to injury by rain if the workmen are not warned in time to stack the trays. Before the weather service was extended over California the loss to this crop from unexpected rains amounted to hundreds of thousands of dollars annually. Testimony from hundreds of owners of vineyards shows that practically not a pound of raisins has been damaged by rain during the past four years.

January 1, 1899, there were in the States of the Rocky Mountain slope 21,000,000 head of sheep and 13,000,000 head of cattle, exclusive of milch cows, horses, and mules. Cattle will live through all except the severest blizzards, but great loss is suffered by sheep owners unless they are able to protect their flocks.

COLD-WAVE WARNINGS.

The cold-wave warnings for these States have attained a much higher degree of accuracy in recent years. Even now an occasional cold wave will sweep over Montana, the Dakotas, Wyoming, and as far south as Colorado and Mexico without warning having been given. This is because cold waves always develop in the British Northwest possessions and cover the north Rocky Mountain plateau, and even reach a portion of our country before the reports from the Canadian stations can give us warning. A system is now in operation over the Rocky Moun-

tain region which enables the Bureau to forewarn stockmen, though by a few hours only, of the coming blizzards.

An unusually cold wave swept over all the States from the Central Rocky Mountain plateau eastward to the Atlantic Ocean in January, 1887. According to estimates from shippers and others, the enormous sum of $3,504,000—three and one-half times the expense of maintaining the entire meteorological service of the Government for one year—was saved as the result of the Department's warnings.

RIVER AND FLOOD WARNINGS.

The speaker said his hearers of the Mississippi region are thoroughly familiar with the value of the river and flood warnings.

The floods of 1881 and 1882 caused a loss of not less than $15,000,000 to property in the Ohio and Mississippi valleys. The floods of 1882 caused a loss of 138 lives in the region from Cairo southward to New Orleans. The loss in the Ohio Valley alone by the flood of 1884 is variously estimated from $10,000,000 to $26,000,000.

During the great flood of 1897, its many stages were very accurately forecast a week in advance throughout practically the whole river system. The value of property saved by flood warnings during this flood in the Lower Mississippi Valley certainly amounted to many million dollars.

When the Mississippi River at New Orleans was at the highest stage ever known, warning was sent there that within five days there would be a rise of 1 foot. The rise came as predicted, but the levees had been strengthened and raised. Without the raise in the height of the levees the loss of life and property would have been unparalleled.

STORM WARNINGS.

The Bureau achieves its most signal success in its warnings of storms destructive to marine property and life. During the past four years not one of the twenty West Indian hurricanes which have swept our seaboard has visited a single port without the danger warnings preceding the storm, and as a result the loss of life and property has been infinitesimal in comparison with the destruction which ensued before the organization of the Department's meteorological service. Conservative marine insurance people estimate that each of these storms would leave from $2,000,000 to $3,000,000 worth of wreckage for them to settle for were it not for the advance information by the Weather Bureau.

EXTENSION OF METEOROLOGICAL SERVICE.

By direction of Secretary Wilson estimates were prepared for a complete meteorological service for the cotton fields of the South, similar to that in operation for the corn and wheat belt of the North, also for an extension of the service over the great arid and subarid regions of the West—a service similar to that which was in operation in the Mississippi Valley. Sixteen new stations were established.

When the war with Spain broke out action was promptly taken for the extension of the meteorological service over the region around the Caribbean Sea, and inside of sixty days a complete meteorological service was reporting twice daily from the principal islands of the West Indies and from the coast regions on the south and west, giving a daily service of atmospheric conditions so far unequaled in any other portion of the globe. The Bureau is thus enabled to detect the development of the most destructive storms that visit our continent, to measure them in their inception, to keep pace with them as they come up through the Caribbean Sea to the Gulf of Mexico, and to warn the commerce of all nations of the coming of the hurricanes.

STUDENT ASSISTANTS.

In accordance with directions of the Secretary some fifteen or twenty bright, deserving young men have been employed as student assistants at stations located in State universities, thus giving them what is equivalent to scholarships at these universities, and the Government has received an adequate return for its expenditure.

HOW WEATHER FORECASTS ARE MADE.

Describing how weather forecasts are made, he said:

Twice daily observations are taken at all the stations in the United States at the same actual moment of time. These are collected by telegraph at the central office in Washington and other forecast centers. When lines are drawn indicating the stations having the same air pressure it is a simple matter to define the regions of high pressure and low pressure, or, in other words, the cool and clear regions, and the warm and moist regions. Weather conditions are dominated by what are called high-pressure and low-pressure areas. They are simply great eddies in the atmosphere drifting from the west toward the east, and controlling the sequence of our weather. Every cold wave is a marked high-pressure eddy, and every general rain storm is a marked low-pressure eddy. In the high-pressure eddy the air is drawn from above and forced outward in all directions from the center. In the low-pressure eddy the air from all directions is drawn inward toward the center and carried upward.

Each meteorological chart shows the location of the highs and lows, their development and drift since the preceding report twelve hours before. It is from a comparison of the current chart with the preceding one that the forecaster makes his estimate of what will be the relative positions of the highs and lows during the coming thirty-six hours. Except the West Indian hurricanes, which visit our Atlantic ports in the fall of the year, all storms in this country move from the west.

The speaker closed with the statement that he believed it impossible to make a forecast based upon any principles of physics or upon any empiric rule in meteorology for a greater period than one or two days in winter or for more than two or three days in summer, and there are days in winter when the movement of air conditions is so rapid that it is extremely difficult to forecast even for a space of one day. "The Weather Bureau takes the public into its confidence in this matter, and does not claim to be able to do more than it is possible to accomplish."

FARMERS' BULLETINS.

These bulletins are sent free of charge to any address upon application to the Secretary of Agriculture, Washington, D. C. Only the following are available for distribution:

No. 16. Leguminous Plants for Green Manuring and for Feeding. Pp. 24.
No. 18. Forage Plants for the South. Pp. 30.
No. 19. Important Insecticides: Directions for Their Preparation and Use. Pp. 20.
No. 21. Barnyard Manure. Pp. 32.
No. 22. Feeding Farm Animals. Pp. 32.
No. 23. Foods: Nutritive Value and Cost. Pp. 32.
No. 24. Hog Cholera and Swine Plague. Pp. 16.
No. 25. Peanuts: Culture and Uses. Pp. 24.
No. 26. Sweet Potatoes: Culture and Uses. Pp. 30.
No. 27. Flax for Seed and Fiber. Pp. 16.
No. 28. Weeds; and How to Kill Them. Pp. 30.
No. 29. Souring of Milk, and Other Changes in Milk Products. Pp. 23.
No. 30. Grape Diseases on the Pacific Coast. Pp. 16.
No. 31. Alfalfa, or Lucern. Pp. 23.
No. 32. Silos and Silage. Pp. 31.
No. 33. Peach Growing for Market. Pp. 24.
No. 34. Meats: Composition and Cooking. Pp. 29.
No. 35. Potato Culture. Pp. 23.
No. 36. Cotton Seed and Its Products. Pp. 16.
No. 37. Kafir Corn: Characteristics, Culture, and Uses. Pp. 12.
No. 38. Spraying for Fruit Diseases. Pp. 12.
No. 39. Onion Culture. Pp. 31.
No. 40. Farm Drainage. Pp. 24.
No. 41. Fowls: Care and Feeding. Pp. 24.
No. 42. Facts About Milk. Pp. 29.
No. 43. Sewage Disposal on the Farm. Pp. 22.
No. 44. Commercial Fertilizers. Pp. 24.
No. 45. Some Insects Injurious to Stored Grain. Pp. 32.
No. 46. Irrigation in Humid Climates. Pp. 27.
No. 47. Insects Affecting the Cotton Plant. Pp. 32.
No. 48. The Manuring of Cotton. Pp. 16.
No. 49. Sheep Feeding. Pp. 24.
No. 50. Sorghum as a Forage Crop. Pp. 24.
No. 51. Standard Varieties of Chickens. Pp. 48.
No. 52. The Sugar Beet. Pp. 48.
No. 53. How to Grow Mushrooms. Pp. 20.
No. 54. Some Common Birds in Their Relation to Agriculture. Pp. 40.
No. 55. The Dairy Herd: Its Formation and Management. Pp. 24.
No. 56. Experiment Station Work—I. Pp. 30.
No. 57. Butter Making on the Farm. Pp. 15.
No. 58. The Soy Bean as a Forage Crop. Pp. 24.
No. 59. Bee Keeping. Pp. 32.
No. 60. Methods of Curing Tobacco. Pp. 16.
No. 61. Asparagus Culture. Pp. 40.
No. 62. Marketing Farm Produce. Pp. 28.
No. 63. Care of Milk on the Farm. Pp. 40.
No. 64. Ducks and Geese. Pp. 48.
No. 65. Experiment Station Work—II. Pp. 32.
No. 66. Meadows and Pastures. Pp. 24.
No. 67. Forestry for Farmers. Pp. 48.
No. 68. The Black Rot of the Cabbage. Pp. 22.
No. 69. Experiment Station Work—III. Pp. 32.
No. 70. The Principal Insect Enemies of the Grape. Pp. 24.
No. 71. Some Essentials of Beef Production. Pp. 24.
No. 72. Cattle Ranges of the Southwest. Pp. 32.
No. 73. Experiment Station Work—IV. Pp. 32.
No. 74. Milk as Food. Pp. 39.
No. 75. The Grain Smuts. Pp. 20.
No. 76. Tomato Growing. Pp. 30.
No. 77. The Liming of Soils. Pp. 19.
No. 78. Experiment Station Work—V. Pp. 32.
No. 79. Experiment Station Work—VI. Pp. 28.
No. 80. The Peach Twig-borer—an Important Enemy of Stone Fruits. Pp. 16.
No. 81. Corn Culture in the South. Pp. 24.
No. 82. The Culture of Tobacco. Pp. 23.
No. 83. Tobacco Soils. Pp. 23.
No. 84. Experiment Station Work—VII. Pp. 32.
No. 85. Fish as Food. Pp. 30.
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No. 87. Experiment Station Work—VIII. Pp. 32.
No. 88. Alkali Lands. Pp. 23.
No. 89. Cowpeas. Pp. 16.
No. 90. The Manufacture of Sorghum Sirup. Pp. 32.
No. 91. Potato Diseases and Their Treatment. Pp. 12.
No. 92. Experiment Station Work—IX. Pp. 30.
No. 93. Sugar as Food. Pp. 27.
No. 94. The Vegetable Garden. Pp. 24.
No. 95. Good Roads for Farmers. Pp. 48.
No. 96. Raising Sheep for Mutton. Pp. 48.
No. 97. Experiment Station Work—X. Pp. 34.